

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
)
Modernizing and Expanding Access to the) WT Docket No. 20-133
70/80/90 GHz Bands)
)

REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING

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By the Commission: Chairwoman Rosenworcel and Commissioner Starks issuing separate statements;
Commissioner Gomez not participating.

TABLE OF CONTENTS

Heading	Paragraph #
I. INTRODUCTION.....	1
II. BACKGROUND.....	3
III. REPORT AND ORDER	9
A. Enabling Point-to-Point Communications to Aircraft and Ships.....	10
1. Authorization and Framework.....	13
2. Technical and Operational Rules.....	24
a. Transmissions Between Aircraft and Ground Stations.....	31
b. Transmissions Between Aircraft In Flight.....	43
c. Transmissions Between Ships, Shore, and Aerostat Stations	53
B. Facilitating Use of the Bands for Backhaul	56
C. Improving the Link Registration System.....	68
1. Construction and Operational Status.....	69
2. De Minimis Modifications to Registrations	77
D. Other Issues.....	80
IV. FURTHER NOTICE OF PROPOSED RULEMAKING.....	85
V. PROCEDURAL MATTERS.....	92
VI. ORDERING CLAUSES.....	102
APPENDIX A—FINAL RULES	
APPENDIX B—FINAL REGULATORY FLEXIBILITY ANALYSIS	
APPENDIX C—INITIAL REGULATORY FLEXIBILITY ANALYSIS	

I. INTRODUCTION

1. The Federal Communications Commission (FCC) continues to play a leading role in fostering innovation in the provisioning of broadband, including through novel technological solutions as well as fifth-generation wireless technology (5G). Meeting the non-stop growth in demand for wireless broadband connectivity is more important than ever due to the outsized impact the Internet has on our work, education, health care, and personal connections. Recognizing this reality, and to help close the

digital divide, in the *Report and Order* portion of this item we adopt new rules and update preexisting ones for the 71–76 GHz, 81–86 GHz, 92–94 GHz, and 94.1–95 GHz bands (collectively, the 70/80/90 GHz bands). And in the *Further Notice of Proposed Rulemaking (Further Notice)* portion, we seek comment on other possible changes to the rules to accommodate additional services. These actions will promote the efficient use of this spectrum and provide opportunities for new broadband service options to be developed.

2. Specifically, based on the record and following extensive consultation with federal stakeholders, in this *Report and Order* we authorize certain point-to-point links to endpoints in motion in the 71–76 GHz (the 70 GHz band) and 81–86 GHz (the 80 GHz band) bands under our part 101 rules to facilitate the use of these frequencies for access to broadband services on aircraft and ships. We also update our rules to permit the use of smaller and lower-cost antennas to facilitate the provision of backhaul service in the 70 GHz and 80 GHz bands and mandate a channelization plan in those bands. And we further adopt changes to the link registration process in the 70/80/90 GHz bands to require certification of construction of registered links, which will promote more efficient use of this spectrum and improve the accuracy of the link registration database. Finally, in the *Further Notice*, we seek comment on the potential inclusion of ship-to-aerostat transmissions as part of maritime operations otherwise authorized in this *Report and Order* and of Fixed Satellite Service (FSS) earth stations in our light-licensing regime for the 70 GHz and 80 GHz bands.

II. BACKGROUND

3. In the United States, the 70/80/90 GHz bands are allocated on a co-primary basis for federal and non-federal use, as follows.¹

Band	Non-Federal Use	Federal Use
71–74 GHz	Fixed, Fixed Satellite, Mobile, and Mobile Satellite	Fixed, Fixed Satellite, Mobile, and Mobile Satellite
74–76 GHz ²	Fixed, Fixed Satellite, Mobile, Broadcasting, and Broadcasting Satellite	Fixed, Fixed Satellite, and Mobile
81–84 GHz ³	Fixed, Fixed Satellite, Mobile, Mobile Satellite, and Radio Astronomy	Fixed, Fixed Satellite, Mobile, Mobile Satellite, and Radio Astronomy
84–86 GHz	Fixed, Fixed Satellite, Mobile, and Radio Astronomy	Fixed, Fixed Satellite, Mobile, and Radio Astronomy
92–94 GHz, 94.1–95 GHz	Fixed, Mobile, Radio Astronomy, and Radiolocation	Fixed, Mobile, Radio Astronomy, and Radiolocation

In the 70 GHz band and 80 GHz band, Fixed, Mobile, and Broadcasting services must not cause harmful interference to, nor claim protection from, Federal Fixed-Satellite Service operations located at 28 military installations.⁴ In addition, in the 80 GHz band, and in the 92–94 GHz and 94.1–95 GHz bands (collectively, the 90 GHz band), licensees proposing to register links located near 18 radio astronomy

¹ 47 CFR § 2.106.

² *Id.* Additional allocations for federal and non-federal use for Space Research are on a secondary basis.

³ *Id.*

⁴ *See id.* § 2.106(c)(389).

observatories must coordinate their proposed links with those observatories.⁵ The 94–94.1 GHz frequencies are allocated for federal use for Earth Exploration Satellite (active), Radiolocation, and Space Research (active) and for non-federal use for Radiolocation.⁶ Additionally, the adjacent 86–92 GHz band is allocated for Federal and non-Federal Earth Exploration-Satellite (passive), Space Research (passive), and Radio Astronomy services and is subject to footnote US246.⁷

4. In 2003, the Commission established service rules for non-federal use of the 70/80/90 GHz bands through a two-step, non-exclusive licensing regime.⁸ Users first obtain a nationwide, non-exclusive license for the entire 12.9 gigahertz of the 70/80/90 GHz bands and then register individual links in a database administered by third-party database managers.⁹ In order for a link to be registered, it must be coordinated successfully with federal operations—typically through the National Telecommunications and Information Administration’s (NTIA’s) online, automated mechanism.¹⁰ Also, the licensee must provide an analysis to the third-party database manager demonstrating that the proposed link will neither cause harmful interference to, nor receive harmful interference from, any previously registered non-government link.¹¹ Licensees are afforded first-in-time priority for successfully registered links relative to links that are successfully registered at a later point in time.¹² Registered links must be constructed within 12 months of their registration. Under part 101, non-federal licensees may use the 70/80/90 GHz bands for any point-to-point, non-broadcast service.¹³

5. In June 2020, the Commission adopted a Notice of Proposed Rulemaking (70/80/90 GHz NPRM) in this proceeding, seeking comment on both adopting new rules and updating preexisting rules to further enable non-federal uses of the 70/80/90 GHz bands.¹⁴ Among a range of issues and proposals—which the Commission said it would work with NTIA to evaluate¹⁵—the 70/80/90 GHz NPRM sought comment on proposals to authorize point-to-point links to endpoints in motion in the 70 GHz and 80 GHz bands to facilitate broadband service to ships and aircraft in motion, as well as on whether to classify

⁵ See *id.* § 2.106(c)(161).

⁶ *Id.* § 2.106.

⁷ See *id.* § 2.106(c)(74), (246).

⁸ *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318, 23322, para. 5 (2003) (70/80/90 GHz Report and Order).

⁹ Since 2004, the Wireless Telecommunications Bureau (WTB) has designated four entities to be database managers but there are currently two database managers: Comsearch and Micronet Communications, Inc. See, e.g., FCC, *Millimeter Wave 70/80/90 GHz Service* (Sept. 26, 2022), <https://www.fcc.gov/millimeter-wave-708090-ghz-service>.

¹⁰ See 47 CFR § 101.1523(b)(3), (c). If a proposed link does not interfere with existing federal operations then it is given a “green light;” if it may interfere with existing federal operations, then it is given a “yellow light,” indicating that the licensee must file a registration application for the link with the FCC for coordination with NTIA. See *id.* § 101.1523(b)(3), (c); 70/80/90 GHz Report and Order, 18 FCC Rcd at 23342–43, para. 54. The “green light” / “yellow light” system protects the sensitive nature of the locations of military installations.

¹¹ See 47 CFR § 101.1523(b)(2); *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Memorandum Opinion and Order, 20 FCC Rcd 4889, 4895–96, paras. 11–14 (2005) (Commission adopted an interference-analysis requirement for registering non-Federal Government licensees).

¹² See 47 CFR § 101.1523(b)(3); 70/80/90 GHz Report and Order, 18 FCC Rcd at 23339–40, para. 45. See also *Wireless Telecommunications Bureau Announces Permanent Process for Registering Links in the 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, Public Notice, 20 FCC Rcd 2261 (WTB 2005).

¹³ 47 CFR § 101.1507.

¹⁴ *Modernizing and Expanding Access to the 70/80/90 GHz Bands*, WT Docket No. 20-133, Notice of Proposed Rulemaking, 35 FCC Rcd 6039 (2020) (70/80/90 GHz NPRM).

¹⁵ *Id.* at 6040, para. 1.

those links as “mobile” service.¹⁶ Noting that the 70/80/90 GHz bands could provide a “unique spectrum resource” for “the provisioning of broadband services to airplanes, ships, and other antennas in motion,”¹⁷ the Commission sought comment on technical and operational rules to allow these new service offerings in the 70 GHz and 80 GHz bands and to mitigate interference to incumbents and other proposed users of these bands and adjacent bands.¹⁸

6. The *70/80/90 GHz NPRM* also proposed several changes to the antenna standards for the 70 GHz and 80 GHz bands to provide greater flexibility in deploying 5G wireless backhaul, noting industry’s assessment of its needs.¹⁹ The *70/80/90 GHz NPRM* sought comment as well on whether adopting a channelization plan would promote more efficient use of the 70 GHz and 80 GHz bands.²⁰ In addition, the *70/80/90 GHz NPRM* asked about whether the Commission should make changes to the link registration rules for the 70, 80, and 90 GHz bands.²¹ Parties including aeronautical and satellite companies,²² radio astronomy interests,²³ equipment manufacturers,²⁴ fixed and mobile wireless entities,²⁵ and organizations focused on meteorology²⁶ filed in response to the *70/80/90 GHz NPRM*. Commenters discussed Aeronet’s proposals, the suitability of the bands for backhaul, and a range of ways to improve the bands’ overall functionality (such as channelization and updates to the relevant antenna standards and link registration process).

7. Following the *70/80/90 GHz NPRM*, in October 2021, the Wireless Telecommunications Bureau (WTB) issued a Public Notice seeking to further develop the record on the use of High Altitude Platform Stations (*HAPS Public Notice*) or other stratospheric-based platform services in the 70/80/90 GHz bands.²⁷ Fifteen Comments and five Reply Comments were filed in response to the *HAPS Public*

¹⁶ *Id.* at 6043–44, para. 7 (citing Petition for Rulemaking of Aeronet Global Communications Inc., RM-11824 (filed Feb. 6, 2019) (Aeronet Aeronautical Petition); Petition for Rulemaking of Aeronet Global Communications Inc., RM-11825 (filed Feb. 6, 2019) (Aeronet Maritime Petition) (collectively, the Aeronet Petitions)). Although the Aeronet Petitions proposed that endpoints in motion operations be permitted in the 70, 80 and 90 GHz bands, several parties that commented on the Aeronet Petitions expressed concerns about co-existence with other services in the 90 GHz band. *See id.* at 6044–45, para. 8. The Commission did not propose to authorize endpoints in motion in the 90 GHz band. *Id.* at 6049–50, paras. 22, 26, n.78.

¹⁷ *Id.* at 6050, para. 25.

¹⁸ *Id.* at 6056–58, paras. 42–45.

¹⁹ *Id.* at 6045–47, paras. 10–15.

²⁰ *Id.* at 6058–99, paras. 46–48.

²¹ *Id.* at 6048–49, paras. 18–21.

²² *See, e.g.*, AIRBUS Comments; Boeing Company Comments; L3 Technologies Comments; SIA Comments; Moog, Inc. Comments. One satellite interest in particular, SpaceX, made numerous filings in this proceeding. Although SpaceX initially opposed the Aeronet Petitions, it subsequently expressed support for Aeronet’s proposed operations. *Compare, e.g.*, SpaceX Reply Comments at 5–7 with Letter from David Goldman, Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed Oct. 12, 2021) (SpaceX Oct. 12, 2021 *Ex Parte*). We discuss SpaceX’s FSS-specific advocacy in Section III.D of this *Report and Order*, and in the *Further Notice* portion of this item, Section IV, *infra*.

²³ *See, e.g.*, MIT Haystack Observatory Comments; NRAO Comments; CORF Comments.

²⁴ *See, e.g.*, Ericsson Comments; Nokia Comments; Qualcomm Comments.

²⁵ *See, e.g.*, CTIA Comments; WISPA Comments; Verizon Comments; AT&T Comments; CCA Comments.

²⁶ *See, e.g.*, American Geophysical Union et al. Comments; EUMETSAT Comments; European Centre for Medium Range Weather Forecasts Comments; World Meteorological Organization Comments.

²⁷ *Wireless Telecommunications Bureau Seeks to Supplement the Record on 70/80/90 GHz Notice of Proposed Rulemaking*, WT Docket No. 20-133, Public Notice, 36 FCC Rcd 14375 (WTB 2021) (*HAPS Public Notice*). The

(continued....)

Notice, with participants ranging from past commenters on the original *70/80/90 GHz NPRM* to additional governmental entities²⁸ and public interest groups,²⁹ among others.

8. In the *70/80/90 GHz NPRM*, the Commission committed to coordinate with NTIA prior to adopting any rules in this proceeding that would affect federal users, given that allocations for the 70 GHz and 80 GHz bands include both federal and non-federal use.³⁰ In response to the *70/80/90 GHz NPRM*, NTIA established a technical interchange group (TIG) with representatives from the affected federal agencies, including National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the National Science Foundation, the Department of the Air Force, and NTIA itself (collectively, the Federal Agencies).³¹ Commission staff participated in regular information exchange meetings with the TIG. The Federal Agencies, through NTIA, submitted a summary of their analyses and a set of proposed interference mitigation measures to the record.³² On October 18, 2023, the Bureau issued a Public Notice seeking to refresh the overall record in this proceeding and seeking comment, in particular, on the Federal Agencies' proposals.³³ Nine parties—eight of which had already participated in the record to date—filed comments in response to the *Refresh Public Notice*.³⁴

III. REPORT AND ORDER

9. After reviewing the record, we adopt rules to allow for point-to-point links to endpoints in motion—specifically, links on aircraft and on ships—in the 70 GHz and 80 GHz bands under our part 101 rules. We also adopt changes to our rules to facilitate the use of the 70 and 80 GHz bands for backhaul, including through the use of smaller antennas, and to improve the accuracy of the link registration database for the 70/80/90 GHz bands. Specifically, we adopt proposals to increase maximum antenna beamwidth from 1.2 degrees to 2.2 degrees; reduce minimum antenna gain from 43 dBi to 38 dBi while retaining the proportional EIRP reduction requirement; eliminate the co-polar and relax the cross-polar discrimination requirements at angles less than 5 degrees; revise the co-polar and cross-polar discrimination requirements at angles between 5 degrees and 180 degrees; and allow minor modifications to registrations in the 70/80/90 GHz bands without the loss of first-in-time rights.³⁵ We further adopt a channelization plan consistent with Recommendation ITU-R F.2006. Finally, we adopt a requirement that licensees certify that each link is constructed and operating within 12 months of successful registration in the link registration system (LRS) administered by third-party database managers.

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Commission's rules define a "High Altitude Platform Station" as a "station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the earth." *Id.* at 14376 (citing 47 CFR § 2.1(c)).

²⁸ See, e.g., NTIA Reply Comments; NASA et al. Comments.

²⁹ See, e.g., New America's Open Technology Institute and Public Knowledge Comments.

³⁰ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6041, para. 2.

³¹ Letter from Charles Cooper, Associate Administrator, Office of Spectrum Management, NTIA, to Ronald T. Repasi, Chief, OET, FCC, and Joel Taubenblatt, Chief, WTB, FCC, WT Docket No. 20-133, at 2 (filed Oct. 17, 2023) (Federal Agencies Letter).

³² See generally *id.*

³³ *Wireless Telecommunications Bureau Seeks to Refresh the Record in 70/80/90 GHz Bands Proceeding*, WT Docket No. 20-133, Public Notice, DA 23-988 (WTB 2023) (*Refresh Public Notice*).

³⁴ See Almagest Space Corp. Refresh Public Notice Comments (first-time proceeding filer Almagest Space Corp. describing itself as a "new satellite operator" with plans to begin deployment in 2024).

³⁵ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6045–46, 6048–49, paras. 11–12, 18–21.

A. Enabling Point-to-Point Communications to Aircraft and Ships

10. Pursuant to Aeronet’s two Petitions for Rulemaking—one addressing aeronautical service, the other maritime service³⁶—the *70/80/90 GHz NPRM* proposed to authorize point-to-point links to endpoints in motion on aircraft and on ships in the 70 GHz and 80 GHz bands.³⁷ The *70/80/90 GHz NPRM* sought comment on this proposal, with a focus on potential impacts on other services, including radio astronomy service (RAS), Earth Exploration-Satellite Service (passive) (EESS), FSS, and terrestrial fixed point-to-point links in the Fixed Service (FS).³⁸

11. As noted above, in the *70/80/90 GHz NPRM*, the Commission committed to coordinate with NTIA prior to adopting any rules in this proceeding that would affect federal users;³⁹ this coordination ultimately resulted in the work of NTIA’s TIG and the submission of the Federal Agencies Letter, which was one of the topics specifically noted in our *Refresh Public Notice*. Both the Federal Agencies Letter and the responsive filings in the record have advanced our efforts to enable innovative new uses of this band in both the aeronautical and the maritime contexts, while ensuring adequate interference protection for incumbents and other authorized services in these and adjacent bands.

12. In order to facilitate increased provision of broadband service and enhanced competition in the aviation and maritime markets, we adopt rules authorizing point-to-point links to endpoints in motion on aircraft and on ships, pursuant to specifications and restrictions described below. These rules will permit increased broadband access in this space while protecting important incumbent and federal operations.

1. Authorization and Framework

13. *Classification of Services.* In its two original Petitions for Rulemaking, Aeronet requested that the Commission categorize its proposed services as fixed services.⁴⁰ In the *70/80/90 GHz NPRM*, however, the Commission instead proposed to classify service to endpoints in motion as a mobile service, because our rules define “fixed service” as a “radiocommunication service between specified fixed points,” which endpoints in motion inherently are not.⁴¹ Several commenters supported our approach, including Boeing, the Fixed Wireless Communications Coalition (FWCC), and Loon, which also requested that we make sure any definition of “mobile” include mobile components of HAPS systems as well.⁴² The Wireless Internet Service Providers Association (WISPA) alone opposed mobile classification, on the grounds that one endpoint of the transmission is fixed, and therefore the service does not reach “full mobility,” and also because the appropriate comparison is with the Fixed Satellite Service, which may provide service to Earth Stations in Motion (ESIMs) without being reclassified as “Mobile-Satellite Services.”⁴³ WISPA also argued that if we do classify services to endpoints in motion as mobile, we should classify them as aeronautical mobile and maritime mobile specifically, as those terms are defined in our existing rules.⁴⁴

³⁶ Aeronet Aeronautical Petition; Aeronet Maritime Petition.

³⁷ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6049–50, para. 22.

³⁸ *Id.* at 6049–50, para. 22; *id.* at 6056–58, paras. 42–45.

³⁹ *Id.* at 6041, para. 2.

⁴⁰ Aeronet Aeronautical Petition at 28; Aeronet Maritime Petition at 26–27.

⁴¹ 47 CFR § 2.1(c); *70/80/90 GHz NPRM*, 35 FCC Rcd at 6052, para. 30.

⁴² Boeing Comments at 6; FWCC Comments at 6–7; Loon Comments at 9–10.

⁴³ WISPA Comments at 7–8.

⁴⁴ *Id.* at 9.

14. We find WISPA's arguments unpersuasive. Other mobile services, for example cellular service, ubiquitously involve transmissions from one fixed point (the base station) to a variety of mobile points (the cell phone), without risking reclassification as a fixed service. As between "mobile" and "aeronautical mobile," we note that a classification as simply "mobile" encompasses aeronautical use. Similarly, as between "mobile" and "maritime mobile," a classification as simply "mobile" encompasses maritime use. Given the otherwise favorable record, and our existing rules, we conclude that the service we authorize today, involving transmissions to and from aeronautical endpoints in motion, is a mobile service.

15. As noted in the *70/80/90 GHz NPRM*, our authorization of a mobile service in the 70 GHz and 80 GHz bands constitutes a revisiting of the Commission's previous actions in the Spectrum Frontiers proceeding.⁴⁵ At that time, the Commission declined to authorize mobile use in the 70 GHz and 80 GHz bands, but reserved the right to revisit the issue of possible methods of promoting coexistence between fixed links and mobile operations as mobile deployments increased in other millimeter-wave bands, as technology developed, and as additional options or frameworks for coexistence of fixed and mobile services in the same band were brought forth.⁴⁶ In the six years since the *2017 Spectrum Frontiers Order*, there have been considerable advances in both technology and sharing paradigms—and Aeronet and other parties have continued to submit new analyses on possible coexistence.⁴⁷ We therefore conclude that revisiting the Commission's previous stance on this matter is warranted and appropriate. We note that the mobile services that we permit pursuant to our decisions in this *Report and Order* are subject to significantly different rules and requirements than the part 30 rules we contemplated in 2017.⁴⁸

16. *Limitation to 70 GHz and 80 GHz Bands.* In the *70/80/90 GHz NPRM*, we noted various concerns already in the record regarding potential harmful interference to Enhanced Flight Vision Systems (EFVS) and Foreign Object Detection (FOD) systems from Aeronet's proposed service in the 90 GHz band and, on that basis, proposed to allow endpoint-in-motion operations only in the 70 GHz and 80 GHz bands, while continuing to seek comment on the issue.⁴⁹ Since then, additional concerns have been raised by numerous other entities regarding proposed aeronautical use of the 90 GHz band, due to both potential incompatibility with proposed use by EFVS and FOD systems,⁵⁰ and potential harmful interference to radio astronomy and remote sensing receivers in the 86–92 GHz band and at 94.0–94.1 GHz.⁵¹ Given the many concerns raised in the record, and the relatively greater interest expressed in

⁴⁵ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6053, para. 33 (citing *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 11054, para. 200 (2017) (*2017 Spectrum Frontiers Order*)).

⁴⁶ *2017 Spectrum Frontiers Order*, 32 FCC Rcd at 11054, paras. 200–01. Indeed, the Commission noted that companies such as Aeronet, Google, and The Elefante Group had filed comments in the Spectrum Frontiers proceeding that "proposed different uses for these bands which neither fit the traditional mobile broadband nor fixed link models." *Id.* (note omitted). See also *70/80/90 GHz NPRM*, 35 FCC Rcd at 6053, para. 33.

⁴⁷ Letter from Samuel L. Feder, Counsel to Aeronet Global Communications Inc., to Marlene H. Dortch, Secretary, FCC, RM-11824, RM-11825 (filed May 10, 2019) (attaching a study by Comsearch entitled "Aeronet Aviation and Maritime Communications Systems: Compatibility with Incumbent E-Band Fixed Services and Link Registration System" (Comsearch Report)).

⁴⁸ See generally 47 CFR pt. 30.

⁴⁹ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6050, para. 26; Sierra Nevada Corp. Comments at 2–3; Moog Reply Comments at 7.

⁵⁰ Airbus Comments at 1; Boeing Comments at 5; Moog Comments at 5; Sierra Nevada Corp. Comments at 2.

⁵¹ American Geophysical Union/American Meteorological Society/National Weather Association Comments at 6; CORF Comments at 2; ETA/EUMETSAT Reply Comments at 2; European Centre for Medium Range Weather Forecasts Reply Comments at 1; IEEE-GRSS FARS Reply Comments at 1–2; NRAO Comments at 3.

expanding use of the 70 GHz and 80 GHz bands, we conclude that the risk of harmful interference to incumbent and adjacent services outweighs the benefit to consumers of allowing service to aeronautical endpoints-in-motion in the 90 GHz band. As proposed in the *70/80/90 GHz NPRM*, we therefore authorize endpoint-in-motion service only in the 70 and 80 GHz bands. At this juncture, the new service covers: (1) in the aeronautical space, ground-to-air and air-to-ground transmissions between ground stations and aircraft, and air-to-air transmission between aircraft in flight; and (2) in the maritime space, ship-to-shore, shore-to-ship, shore-to-aerostat, aerostat-to-ship, aerostat-to-shore, and ship-to-ship transmissions.⁵²

17. *Coordination, Licensing, and Registration.* In the *70/80/90 GHz NPRM*, the Commission sought comment generally on what changes to the 70/80/90 GHz coordination, licensing, and registration framework might be necessary in order to facilitate the operation of endpoints in motion under part 101.⁵³ The Commission also proposed to incorporate such operations, to the extent ultimately authorized, into the current framework of non-exclusive, nationwide licensing used for fixed point-to-point operations in these bands.⁵⁴ The record is fairly thin on the specifics of the appropriate licensing framework; most commenters focused on whether we should authorize this service as an initial matter. However, several commenters did voice support for including any new service in the existing third-party database management system.⁵⁵

18. In order to allow service to aeronautical and maritime endpoints in motion to deploy efficiently and without causing harmful interference to incumbent operations and other services in these bands, the applicable licensing mechanism must support adequate coordination with those other services without being unduly burdensome on both incumbent and new operators. To this end, we will require prospective operators of service to aeronautical and maritime endpoints in motion to first apply for and receive a nationwide, non-exclusive license. This license will establish the prospective operator's qualification to be a licensee and will serve as a blanket license for: (1) on the aeronautical side, air-to-air operations, and as a prerequisite to register ground-to-air (GTA) stations and associated air-to-ground (ATG) transmission; and (2) on the maritime side, as a prerequisite to register ship-to-shore, shore-to-ship, shore-to-aerostat, aerostat-to-ship, and aerostat-to-shore transmissions. We clarify that as of the effective date of the rules we are adopting today, all nationwide, non-exclusive licenses for the 70/80/90 GHz service will include the service areas set forth in section 101.1501 as revised today.⁵⁶

19. In the matter of coordinating and registering individual aeronautical stations and links, we proposed in the *70/80/90 GHz NPRM* to require coordination and registration for not only GTA stations and ATG transmissions, but also air-to-air links between two aircraft in motion.⁵⁷ We also sought comment on how all types of links should be represented or described in their registrations, as the current system, designed for fixed point-to-point links on the ground, does not account for potential differences in altitude or the varying orientation of links to endpoints in motion.⁵⁸ Several commenters noted the potential difficulty of coordinating air-to-air links, due not only to these different characteristics, but also

⁵² For purposes of both the *Report and Order* and *Further Notice*, we consider the term “aerostat” to mean an airborne transmitter operating within a small specified area, below 1,000 feet of elevation, regardless of method of propulsion.

⁵³ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6054, para. 35.

⁵⁴ *Id.*

⁵⁵ DSA Reply Comments at 2–3, SIA Comments at 8, Letter from David Goldman, Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1 (filed Nov. 8, 2021) (SpaceX Nov. 8, 2021 *Ex Parte*).

⁵⁶ See *infra* Appx. A. at 47 CFR § 101.1501.

⁵⁷ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6054, para. 36.

⁵⁸ *Id.* at 6055, para. 37.

their temporary and transient nature.⁵⁹ Aeronet proposed coordinating three-dimensional polyhedrons for air-to-air links, which DSA supports, within a horizontal altitude band from 10,000 to 50,000 feet.⁶⁰ However, concerns in the record about potential harmful interference from air-to-air transmissions stem mainly from such transmissions' specific angle, direction, or distance from specific sites (most of which would not be addressed by registration of polyhedrons) that can be addressed directly with specific limitations.⁶¹ Due to the difficulties of adequately representing the potential interference from these links in the existing database structure,⁶² and in light of the various interference mitigation measures we also adopt (discussed below) to answer those concerns, we will not require registration or coordination of individual air-to-air links.

20. In the matter of coordinating and registering individual maritime stations and links, the Commission proposed in the *70/80/90 GHz NPRM* to require coordination and registration for not only ship-to-shore and shore-to-ship transmissions, but also ship-to-ship and ship-to-node (i.e., as described in this item ship-to-aerostat).⁶³ The Commission also sought comment on how all types of links should be represented or described in their registrations, as the current system—designed for two-dimensional fixed point-to-point links on the ground—does not account for potential differences in three-dimensional space-to-endpoints in motion.⁶⁴ As explained immediately above, commenters focused on the potential difficulty of coordinating air-to-air links, and Aeronet proposed a system of three-dimensional polyhedrons for the same. Similar in-depth discussion around maritime-related links did not develop in the record.

21. After receiving the nationwide license, aeronautical operators will coordinate with federal operators and register GTA stations and associated ATG transmissions, and must not operate such facilities until registration has successfully been completed. Air-to-air operations will not be separately registered but may only operate under a nationwide license if the communication is associated with a registered GTA or ATG registration. All GTA and ATG operations, including operations transmitting to or from aeronautical endpoints in motion and associated ground stations, will be afforded protection from other operations on a first-in-time basis, and must afford those other operations the relevant first-in-time protections in turn.⁶⁵

22. After receiving the nationwide license, maritime operators will coordinate with federal operators and register shore-to-ship transmitters, shore-to-aerostat transmitters, ship-to-shore transmitters, and aerostat relay stations. As with GTA and ATG transmissions, all such maritime operators must not

⁵⁹ CORF Comments at 2.

⁶⁰ Aeronet Aeronautical Petition at 14; DSA Comments at 4.

⁶¹ See, e.g., Federal Agencies Letter.

⁶² See Comsearch HAPS Public Notice Comments at 2 (citing Comsearch Comments at 17: “[A]ny concept of recording polyhedrons, cones, or polygons to represent mobile operations, or likewise any other approach to database information to describe these operations would constitute a major change to the current registration database structure and process.”).

⁶³ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6054, para. 36.

⁶⁴ *Id.* at 6055, para. 37.

⁶⁵ We note the request of CTIA and others that we grant priority to fixed service in these bands over new uses. CTIA Refresh Public Notice Comments at 6; see also, e.g., AT&T Refresh Public Notice Comments at 3–4. Fixed service in these bands has been co-primary with other services, including mobile service, for some time. See 47 CFR § 2.106. Adopting new service rules for these existing allocations does not change the co-primary status of the fixed service. Additionally, incorporating these new aeronautical and maritime services into the existing registration regime with first-in-time protection effectively protects all existing operations, including fixed operations, from all deployments in these services. That subsequent deployments will be protected from each other on a first in time basis is also consistent with the co-primary nature of the allocations.

operate any facilities until registration has successfully been completed. All such maritime operations will be afforded protection from other operations on a first-in-time basis and must afford those other operations the relevant first-in-time protections in turn.

23. We delegate authority to WTB to establish specific procedures to be followed for coordinating and registering aeronautical and maritime stations and their associated transmissions, to be set forth in a future publication or publications. We note, in relation to technical discussion raised by certain parties in the docket,⁶⁶ that validation of new aeronautical and maritime systems' ability to not cause interference may involve processes beyond the third-party database system.⁶⁷ Additionally, we delegate authority to WTB and the Office of Engineering and Technology (OET) to establish a process, in coordination with NTIA, for demonstrating that technologies for point-to-endpoint-in-motion communications to aircraft and ships are capable of meeting the specific technical and operating requirements adopted in this *Report and Order*. We instruct WTB and OET to take such actions as authorized by sections 0.241(l) and 0.331(g) of our rules, which we adopt today, and to do so expeditiously.

2. Technical and Operational Rules

24. In the *70/80/90 GHz NPRM* we sought comment on what changes to our current rules might be necessary to facilitate the contemplated aeronautical and maritime services, while protecting incumbent and federal operations.⁶⁸ We also sought comment generally on any interference mitigation measures not specifically mentioned that might be necessary to protect other operations.⁶⁹

25. In response to the *70/80/90 GHz NPRM*, some commenters argued—focusing on the aeronautical context in particular—that a more developed record would be necessary to support the authorization of aeronautical mobile service along the lines proposed by Aeronet, given the potential for interference to incumbent and other potential services.⁷⁰ Other commenters disagreed.⁷¹ Maritime service was largely unaddressed in the record. A small number of parties—including SpaceX, T-Mobile, and Verizon⁷²—raised more specific, albeit still highly generalized, objections to the *70/80/90 GHz NPRM*'s

⁶⁶ See, e.g., Comsearch Refresh Public Notice Comments at 1–2 (articulating, consistent with past filings from the same party, how certain changes might “require major modifications to the databases or most likely entirely new structures” (internal quotations, citation omitted)).

⁶⁷ See generally *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23341–45, paras. 48–60 (detailing the coordination and registration regime for the 70/80/90 GHz bands, including the use of third-party database managers); *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Order, 19 FCC Rcd 20524 (WTB 2004) (designating three entities as database Managers “tasked with jointly developing and managing databases of link registrations by FCC licensees in the 71–76 GHz, 81–86 GHz and 92–95 GHz bands (collectively, link registration system)”).

⁶⁸ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6055–58, paras. 40–46.

⁶⁹ *Id.* at 6057, para. 45.

⁷⁰ Letter from Gregory Coutros, Associate Corporate Counsel, Regulatory Affairs, Hughes Network Systems, LLC, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1–2 (filed Feb. 26, 2021) (Hughes Feb. 26, 2021 *Ex Parte*); Letter from Jennifer Manner, Senior Vice President, Regulatory Affairs, Hughes Network Systems, LLC, and David Goldman, Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 2 (filed Dec. 7, 2020).

⁷¹ Letter from Dowel V. King, Sr. Manager, Contracts, L3 Technologies, Inc. Communications Systems West, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 2 (filed May 18, 2021) (L3Harris May 18, 2021 *Ex Parte*).

⁷² SpaceX Reply Comments at 2; T-Mobile Comments at 2–3 and 10–11; Verizon Comments at 2–3.

proposed maritime authorizations, citing in part concerns over potential impacts on fixed wireless backhaul, among other issues. Others generally endorsed the adoption of the proposed maritime regime.⁷³

26. Since the initial comment period to the *70/80/90 GHz NPRM*, additional submissions to the record, including detailed contributions from NTIA and other federal agencies, have enhanced the depth of the record.⁷⁴ Our increased understanding of potential interactions between Aeronet's proposed service and incumbent, adjacent, and other potential operations, including sensitive operations such as weather satellites in the EESS, now allows us to set forth a series of technical and operational rules calculated to protect all services within the 70/80 GHz bands, and adjacent to them, from harmful interference.

27. Except as noted below, the aeronautical and maritime mobile services we authorize today will be governed by part 101 of our rules. Though part 101 currently encompasses only fixed services, we find it appropriate to place the service rules governing aeronautical and maritime mobile services in the 70 and 80 GHz bands within the same rule part. In addition, operators of these new services must coordinate with operators in the existing FS, and part 101 is the logical home for rules related to that coordination. The technical and operational rules we set forth below are sufficient to accommodate the different technical characteristics of these aeronautical and maritime transmissions.

28. *Guard Bands.* We did not specifically seek comment in the *70/80/90 GHz NPRM* on the potential use of guard bands as means of protecting services in adjacent bands from harmful interference. Several commenters suggest them, particularly to protect both EESS satellites and RAS facilities in the 86–92 GHz band.⁷⁵ However, the analysis submitted by the Federal Agencies, which includes NASA and NOAA, instead relies upon specified out of band emissions (OOBE) limits to protect EESS.⁷⁶ Because the Federal Agencies' analysis supports coexistence between the new aeronautical and maritime services and services in adjacent bands without the use of a guard band, no commenters objected to the lack of guard bands in response to the *Refresh Public Notice*, and based on our engineering analysis of the Federal Agencies' recommendations, we decline to adopt guard bands as an interference protection measure here.

29. *Transmission Power Levels.* In the *70/80/90 GHz NPRM*, we sought comment on Aeronet's request to increase the maximum allowable mobile equivalent isotropically radiated power (EIRP) for the 70 and 80 GHz bands from +55 dBW to +57 dBW.⁷⁷ CORF and satellite operators objected to this proposal, on the grounds that an increased power level would unacceptably increase the risk of harmful interference to FSS and RAS operations.⁷⁸ Qualcomm supported the increase, arguing

⁷³ See, e.g., SIA Comments at 7–8; Nokia Reply Comments at 3; L3 Technologies Comments at 1–2.

⁷⁴ See Federal Agencies Letter; Letter from Roger Sherman, Counsel to Aeronet Global Communications Inc., to Marlene H. Dortch, Secretary, FCC, WT 20-133 (filed May 12, 2022); Letter from Jameson Dempsey, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed May 23, 2022) (SpaceX May 23, 2022 *Ex Parte*); Letter from Jameson Dempsey, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed July 25, 2022) (SpaceX July 25, 2022 *Ex Parte*). The Federal Agencies Letter in particular contains detailed analysis and specific actionable recommendations for interference mitigation. See Federal Agencies Letter, Attach. B; *id.*, Attach. C.

⁷⁵ Letter from Dan DePodwin, Manager of Forecasting Operations, AccuWeather, Inc. et al., to Marlene H. Dortch, Secretary, FCC, WT 20-133, at 2–3 (filed Sept. 17, 2020); CORF Comments at 2; American Astronomical Society Comments at 2; IEEE-GRSS Reply Comments at 1–2; NRAO Comments at 3.

⁷⁶ Federal Agencies Letter, Attach. A at 1.

⁷⁷ *70/80/90 GHz NPRM*, 35 FCC Rcd at 5056, para. 42.

⁷⁸ Hughes Feb. 26, 2021 *Ex Parte*; CORF Comments at 2; SIA Comments at 5–6.

that atmospheric attenuation in these bands should be sufficient to mitigate interference concerns.⁷⁹ Aeronet argues that the proposed increase is minimal and that the highly directional nature of transmissions in its proposed service will work to avoid incidents of harmful interference.⁸⁰ The Federal Agencies' analysis of potential interference into federal operations assumes +57 dBW, and suggests that the recommended interference mitigation measures in its report would be sufficient to protect federal operations from an aeronautical mobile service operating at that power level.⁸¹

30. We acknowledge the concerns of satellite operators and the RAS community about potential interference from the services that this item contemplates, as discussed in more detail below. However, the Federal Agencies' analysis addresses potential harmful interference to both RAS and FSS operations, and we find it persuasive based on our review of the record and our independent analysis. As we also adopt the interference mitigation measures recommended in that report, we adopt a maximum EIRP level of +57 dBW for transmissions in these new aeronautical and maritime mobile services.

a. Transmissions Between Aircraft and Ground Stations

31. In introducing a new aeronautical mobile service to these bands, care must be taken to ensure compatibility with existing and other authorized services, both in the 70 GHz and 80 GHz bands, and adjacent to them. The record reflects a variety of concerns about the potential impact on these other services. To address these concerns, we adopt a number of interference mitigation measures specifically related to transmissions between ground stations and aircraft in flight, described below. Ground-to-air and air-to-ground transmissions are limited to the 80 GHz and 70 GHz bands, respectively; ground stations must be located a minimum distance away from RAS facilities, fixed stations, and FSS earth stations; specific OOB limits above 86 GHz must be observed; and minimum and maximum elevation angles for ground-to-air transmissions are required.

32. Several commenters expressed concern regarding air-to-ground transmissions in the 80 GHz band, due to the potential for such transmissions to cause harmful interference to RAS operations.⁸² No party, including Aeronet, has argued that downlink transmissions in the 80 GHz band are necessary to provide aeronautical service, provided that the 70 GHz band is available for that purpose. AT&T notes in its comments that a channel plan that designates different parts of the 70 GHz or 80 GHz bands for uplink versus downlink signals would be beneficial to reduce self-interference to air-to-ground and ground-to-air mobile systems.⁸³ In addition, having air-to-ground transmissions in the 70 GHz band and ground-to-air transmissions in the 80 GHz band creates directional consistency with the bands designated for space-to-Earth (71–76 GHz) and Earth-to-space (81–86 GHz) in the FSS service. Aeronet's technical study indicates compatibility with the FSS services while assuming air-to-ground transmissions in the 70 GHz band and ground-to-air transmissions in the 80 GHz band.⁸⁴ SpaceX supported Aeronet's study.⁸⁵ We therefore authorize air-to-ground transmissions only in the 70 GHz band.

33. Many commenters suggested that some separation distance between aeronautical ground stations and operations of other services, including RAS stations, FSS earth stations, and fixed point-to-

⁷⁹ Qualcomm Comments at 10.

⁸⁰ Aeronet Comments at 1–2; Aeronet Reply Comments at 2.

⁸¹ See Federal Agencies Letter at 2; *id.*, Attach. B at 2.

⁸² CORF Comments at 2; NRAO Comments at 8; Federal Agencies Letter, Attach. C at 1.

⁸³ AT&T Comments at 10.

⁸⁴ Letter from Roger Sherman, Counsel to Aeronet Global Communications Inc., to Marlene H. Dortch, Secretary, FCC, WT 20-133, Attach. at 4 (filed Oct. 4, 2021) (Aeronet Oct. 4, 2021 *Ex Parte*) (filing attaching a September 2021 study entitled “Aviation-Satellite Coexistence in the 70 and 80 GHz bands”).

⁸⁵ SpaceX Oct. 12, 2021 *Ex Parte* at 1.

point links, would be either advisable or necessary to reduce the risk of harmful interference.⁸⁶ The Federal Agencies’ analysis provides specific values for such separation distances: greater than 10 km for licensed FSS earth stations, 10 km for fixed point-to-point transmitters, and 150 km for RAS operations.⁸⁷ That analysis also asserts that in order to protect RAS operations, ground stations should not transmit in the direction of an RAS facility, or receive transmissions from aircraft in that direction, such that the transmission enters the appropriate “zone of avoidance” around the facility.⁸⁸ In response to the *Refresh Public Notice*, NRAO raised concerns that this 150 km separation distance may be inadequate to protect RAS operations in the 76–81 GHz band specifically.⁸⁹

34. We find the conclusions of the Federal Agencies’ analysis persuasive. No other party has submitted alternative suggestions for separation distances with respect to federal operations. With regard to NRAO’s concerns, we note that as the Technical Interchange Group that produced the Federal Agencies Letter specifically considered interference into the 76–81 GHz band, and as NSF, with which NRAO is affiliated, participated in the TIG and endorsed its output, we will defer to the expertise of NSF in this matter.⁹⁰ Accordingly, we adopt a minimum separation distance of 150 km between RAS facilities and aeronautical ground stations.

35. With respect to FS and FSS, although the 10 km distances were calculated specifically with federal operations in mind, we find that a 10 km distance separation should apply with respect to non-federal operations in these services. With respect to FSS, the record generally supports the 10 km separation distance without objection. For example, Aeronet’s study showing compatibility between its system and FSS concluded that a 10 km separation distance would be sufficient to prevent interference⁹¹ and SpaceX supports this conclusion.⁹² With respect to FS, Aeronet contends that applying a 10 km separation requirement for ground stations is unnecessary and possibly counterproductive given that Aeronet expects to, in some cases, be able to co-locate with backhaul links.⁹³ FWCC and CTIA, on the other hand, assert that the 10 km separation distance is necessary to protect non-Federal FS stations.⁹⁴ Based on our assessment of the record, we do not find any technical reason to adopt a different separation distance between ground stations and non-Federal FS stations than we adopt for the separation between ground stations and Federal FS stations. Moreover, in response to Aeronet’s concern that a 10 km separation distance could preclude co-location of ground stations with backhaul links, we note that

⁸⁶ DSA Comments at 3–4; Letter from Martin L. Stern and E. Barlow Keener, Counsel to Sceye Inc., to Marlene H. Dortch, Secretary, FCC, WT 20-133, at 3 (filed Apr. 19, 2022); SpaceX HAPS Public Notice Comments at 4; NSF HAPS Public Notice Comments at 2.

⁸⁷ Federal Agencies Letter, Attach. A at 1–2; *id.*, Attach. B at 4, 11.

⁸⁸ Federal Agencies Letter, Attach. B at 4.

⁸⁹ NRAO Refresh Public Notice Comments at 1.

⁹⁰ See Federal Agencies Letter, Attach. A at 1 (separate entries for mitigating adjacent band interference into both 86–92 GHz and 76–81 GHz), Federal Agencies Letter at 1 (listing participating agencies, including NSF); see also NSF, *Master Government List of Federally Funded R&D Centers* (Feb. 2023), <https://www.nsf.gov/statistics/ffrdclist/> (enumerating all Federally Funded Research and Development Centers and their sponsors—including, for NRAO, NSF).

⁹¹ Aeronet Oct. 4, 2021 *Ex Parte*, Attach. at 2.

⁹² SpaceX Oct. 12, 2021 *Ex Parte* at 1 (“SpaceX supports Aeronet’s ‘very conservative’ conclusion that a coordination area of 10 kilometers would prevent harmful interference between its ground stations and FSS gateways in the 70/80 GHz bands.”).

⁹³ Aeronet Jan. 11, 2023 *Ex Parte* at 2–3.

⁹⁴ Letter from Seth L. Williams, Counsel, FWCC, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 2 (filed Jan. 18, 2024); Letter from Michael Mullinix, Vice President—Regulatory Affairs, CTIA, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 2–3 (filed Jan. 18, 2024).

ground stations can be separated less than 10 km from backhaul links pursuant to coordination agreements, and we encourage all parties to explore more efficient interference protection parameters in the context of those discussions. We find that a 10 km coordination requirement strikes the appropriate balance for sharing between the longstanding use of the bands under the fixed allocation and the new uses under the co-primary mobile allocation—including ground stations with antennas that are not static.

36. While Comsearch assumed a larger coordination area around FS stations than 10 km, we note that its analysis uses conservative assumptions to calculate an area on the ground that could be illuminated by an aircraft antenna.⁹⁵ This worst-case calculation does not take into account a number of factors that would reduce the interference potential, most notably the directional nature of transmissions from the aircraft. Considering the relative potential interference between ground stations and FSS versus FS, we note the following: (1) the elevation angle of FSS earth station receive antennas makes them more likely to be co-linear with the air-to-ground link; (2) due to the long path from space-to-Earth, the desired signal at a satellite earth station from a satellite would typically be weaker than the desired signal at an FS receiver from its transmitter (in other words, the C in the C/I ratio would be higher for any FS station); and (3) the Federal FSS study assumed an interference threshold of $I/N = -12.2$ dB would be required to protect FSS, whereas the typical interference threshold for FS is 1.0 dB of degradation of the static threshold of the protected receiver,⁹⁶ which equates to an I/N of -6 dB. These factors all indicate that FS would be less susceptible to interference from air-to-ground or ground-to-air links than FSS. We therefore conclude that there is no need for the separation distance between ground stations and FS stations to be any greater than the separation distance between ground stations and FSS stations. Accordingly, we adopt a minimum separation distance 10 km between proposed aeronautical ground stations and any registered fixed point-to-point transmitter or FSS earth station, Federal or non-Federal, in the absence of a coordination agreement with the fixed station or FSS earth station operator.

37. Commenters in the record evidenced significant concern regarding protection of EESS sensors above 86 GHz from harmful interference due to spurious emissions from the 80 GHz band.⁹⁷ We sought comment on what interference mitigation measures might be necessary to protect EESS services operating in the 86–92 GHz band.⁹⁸ CORF, ESA/EUMETSAT, and the World Meteorological Organization suggest that the OOB limits in our rules should be updated to conform to the standard set forth in ITU-R Resolution 750.⁹⁹ The Federal Agencies, based on an independent analysis incorporating specific details of Aeronet’s proposed system, recommend an OOB limit of -38.5 dBW in any 100 megahertz of the passive band 86–92 GHz for ground-to-air transmissions.¹⁰⁰

38. We find the recommendation of the Federal Agencies to be persuasive. We acknowledge that this OOB limit is slightly more lenient than that urged by CORF and others. However, the Federal Agencies’ analysis takes into account specific characteristics of Aeronet’s proposed system. We are therefore confident that their resulting conclusions are sufficient to adequately protect EESS operations.

⁹⁵ For example, the Comsearch analysis assumes an aircraft altitude of 50,000 ft—see Comsearch Report at 22—whereas most commercial aircraft typically fly between 31,000 and 38,000 feet.

⁹⁶ 47 CFR § 101.105; TIA-10-A, Interference Criteria for Microwave Systems (TIA 2023), <https://tiaonline.org/standardannouncement/tia-issues-new-interference-criteria-for-microwave-systems-standard/>.

⁹⁷ AGU/AMS/NWA Comments at 6; CORF Comments at 2; ESA/EUMETSAT Reply Comments at 1; European Centre for Medium Range Weather Forecasts Comments at 1; World Meteorological Organization Reply Comments at 2.

⁹⁸ 70/80/90 GHz NPRM, 35 FCC Rcd at 6056, para. 42.

⁹⁹ CORF Comments at 2; ESA/EUMETSAT Reply Comments at 1; World Meteorological Organization Reply Comments at 2.

¹⁰⁰ See Letter from Charles Cooper, Associate Administrator, Office of Spectrum Management, NTIA, to Ronald T. Repasi, Chief, OET, FCC, and Joel Taubenblatt, Chief, WTB, FCC, WT Docket No. 20-133, at 1–2 (filed Dec. 29, 2023) (Federal Agencies Clarification Letter); see also Federal Agencies Letter, Attach. A at 1; *id.*, Attach. B at 8–9.

We adopt an OOB limit of -38.5 dBW in any 100 megahertz of the passive band 86–92 GHz for ground-to-air transmissions.

39. *Minimum and Maximum Elevation Angles.* In the 70/80/90 GHz NPRM, we sought comment on a minimum elevation angle of five degrees for transmissions from ground stations, consistent with the parameters in Aeronet’s initial petition.¹⁰¹ Some commenters suggest that lower elevation angles, such as three or even 1.5 degrees, would be sufficient to prevent harmful interference.¹⁰² Hughes argues that lower elevation angles might require larger separation distances between these aeronautical ground stations and FSS ground stations, thereby hampering future deployment of FSS service.¹⁰³ Geneva Communications is generally supportive of some minimum elevation angle in order to protect incumbent Fixed users,¹⁰⁴ and FWCC supports a five degree minimum specifically.¹⁰⁵ Loon argues that any minimum elevation angle would favor some systems or business models over others, and thereby restrict competition.¹⁰⁶ Comsearch’s analysis of the potential impact of Aeronet’s proposed service on other services in the 70/80/90 GHz bands concludes that a minimum elevation angle of five degrees significantly mitigates the potential for interference into fixed point-to-point links.¹⁰⁷ Aeronet subsequently indicated that a minimum elevation angle of five degrees could impact deployment timing and costs compared to a lower angle such as three degrees.¹⁰⁸

40. We adopt a minimum elevation angle of five degrees for ground stations in this aeronautical service. This is consistent with Aeronet’s initial petition and with the record before us.¹⁰⁹ We find Loon’s argument against any minimum elevation angle unpersuasive. Elevation angle is routinely an area of potential concern in bands where terrestrial service coexists with services operating at altitude; for example, part 25 of our rules, which provides the default rules for satellite operations, requires that satellite earth stations not transmit at elevation angles below five degrees in any band shared with a terrestrial radio service.¹¹⁰ Adopting a similar restriction on aeronautical services is motivated by similar interference protection concerns and remains a technology-neutral requirement. Given the concerns raised in the record about lower elevation angles, we conclude that five degrees is the most appropriate value. That said, we recognize the benefits to efficient spectrum use, and ultimately consumers, of permitting parties to agree to less stringent interference mitigation measures than required

¹⁰¹ 70/80/90 GHz NPRM, 35 FCC Rcd at 6056, para. 43; Aeronet Aeronautical Petition at 14.

¹⁰² L3Harris May 18, 2021 *Ex Parte* at 2; Letter from John W. Kuzin, Vice President and Regulatory Counsel, Qualcomm Incorporated, to Marlene H. Dortch, Secretary, FCC, WT 20-133, at 1 (filed Jan. 8, 2021).

¹⁰³ Hughes Feb. 26, 2021 *Ex Parte* at 2.

¹⁰⁴ Letter from Wesley K. Wright, Counsel to McKay Brothers, LLC, to Marlene H. Dortch, Secretary, FCC, WT 20-133, at 2 (filed June 2, 2022).

¹⁰⁵ FWCC Comments at 6–7.

¹⁰⁶ Loon Reply Comments at 3.

¹⁰⁷ Comsearch Report at 3.

¹⁰⁸ See Aeronet Jan. 10, 2024 *Ex Parte* at 1 (seeking “an expedited process for Commission staff or the future database administrator to adjust the minimum angle after appropriate coordination with potentially impacted parties based on real-world data”).

¹⁰⁹ We note that the Federal Agencies Clarification Letter stated that one study initially conducted by the Federal Agencies assumed 3 degree minimum elevation angles. Federal Agencies Clarification Letter at 1–2. However, in the record before us Aeronet has only proposed a 5 degree minimum elevation angle, both in its own Petition and in studies that Aeronet commissioned. See, e.g., Aeronet Aeronautical Petition at 14; Comsearch Report at 3–4, 21–22. The OOB limit of -38.5 dBW in any 100 megahertz of the passive band 86–92 GHz for ground-to-air transmissions, as recommended in the Federal Agencies Clarification Letter, accounts for a 5 degree minimum elevation angle.

¹¹⁰ 47 CFR § 25.205.

under our rules. Accordingly, WTB will consider any request for waiver of this rule through our existing regulatory processes,¹¹¹ subject to coordination with NTIA to ensure that federal incumbents are protected from harmful interference and, as Aeronet suggests, “coordination with other potentially impacted parties based on real-world data.”¹¹²

41. We also adopt a maximum elevation angle of forty-five degrees for aeronautical ground stations. Though this parameter was not included in Aeronet’s petition, it is the maximum elevation angle used by the Federal Agencies in their analysis of potential harmful interference to federal operations, and these assumptions about likely operational parameters were based on input from Aeronet.¹¹³ Because this analysis shows that elevation angles of up to forty-five degrees can (under certain other parameters) coexist successfully with federal operations, and because we lack evidence in the record that transmissions above that angle of elevation will not cause harmful interference to federal or other satellite operations, we adopt a maximum elevation angle of forty-five degrees.

42. Together, these technical parameters and interference mitigation measures will ensure that operators in this aeronautical mobile service will be able to successfully operate, while also protecting operators in other services.

b. Transmissions Between Aircraft In Flight

43. Air-to-air transmissions present a unique set of characteristics in terms of the potential for interaction with other services, in both the same and adjacent bands, and accordingly, considerable attention has been paid to how harmful interference from such transmissions might be avoided. In the *70/80/90 GHz NPRM*, the Commission sought comment generally on potential interference mitigation measures.¹¹⁴ Many commenters raised concerns about the potential for harmful interference into other services, particularly RAS sites above 86 GHz.¹¹⁵ In response to these concerns, Aeronet, Comsearch, and other commenters suggested a variety of potential mitigation measures.¹¹⁶ In particular, the Federal Agencies submitted a report with both suggested interference mitigation measures and underlying analysis supporting them, which they suggest would be sufficient to protect federal operations both in the 70/80 GHz bands and in adjacent bands from harmful interference from air-to-air transmissions.

44. After reviewing the record, and as discussed in more detail below, we adopt the following technical and operational restrictions on transmissions between aircraft in flight, in order to reduce the risk of harmful interference to other services. Air-to-air transmissions will be authorized in both the 70 GHz and 80 GHz bands. We establish an OOB limit of -29.7 dBW in any 100 megahertz of the passive band 86–92 GHz, to protect EESS (passive) operations. In the 80 GHz band, we set a maximum allowed EIRP signal level towards any of a specified list of RAS sites, varying by transmission frequency and distance from the site. In the 70 GHz band, we adopt a similar limit on EIRP signal levels toward specified military installations. Finally, we adopt both altitude restrictions and a minimum slant path

¹¹¹ 47 CFR § 1.925(b)(3) (grant of a waiver request requires a showing that “the underlying purpose of the rule(s) would not be served or would be frustrated by application to the instant case, and that a grant of the requested waiver would be in the public interest; or in view of unique or unusual factual circumstances of the instant case, application of the rule(s) would be inequitable, unduly burdensome or contrary to the public interest, or the applicant has no reasonable alternative”).

¹¹² Aeronet Jan. 10, 2024 *Ex Parte* at 1.

¹¹³ Federal Agencies Letter, Attach. B at 7.

¹¹⁴ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6057, para. 45.

¹¹⁵ American Geophysical Union et al. Comments at 6; CORF Comments at 2; ETA/EUMETSAT Reply Comments at 2; European Centre for Medium Range Weather Forecasts Reply Comments at 1; IEEE-GRSS FARS Reply Comments at 1–2; NRAO Comments at 3.

¹¹⁶ See e.g., Aeronet Comments at 1–2, 3; Comsearch Report at 42–44; Federal Agencies Letter, Attach. A.

distance requirement in order to reduce the risk of harmful interference to in-band services, particularly fixed point-to-point links.

45. Several commenters raised concerns in the record that air-to-air transmissions in the 80 GHz band might produce unwanted emissions into the band above 86 GHz that might cause harmful interference to services in that band, particularly RAS observatories and EESS operations.¹¹⁷ We agree with commenters on the importance of protecting RAS and EESS operations in the 86–92 GHz band. However, based on the analysis by the Federal Agencies, we conclude that the interference mitigation measures we adopt today, which include restrictions on transmissions in the direction of RAS sites, are sufficient to allow air-to-air transmissions in both the 70 GHz and 80 GHz bands.

46. In the *70/80/90 GHz NPRM*, we sought general comment on what interference mitigation measures might be necessary to protect EESS and RAS services operating in the 86–92 GHz band.¹¹⁸ Among the measures proposed by commenters relating to air-to-air transmissions were limiting those transmissions to the 70 GHz band¹¹⁹ and updating the OOB limits to reflect recent ITU standards.¹²⁰ Several commenters also discussed the need for any air-to-air transmissions to avoid pointing directly at an RAS receiver.¹²¹ The Federal Agencies' analysis recommends an OOB limit of -29.7 dBW in any 100 megahertz of the passive band 86–92 GHz for air-to-air transmissions in order to protect EESS sensors, and a set of restrictions on EIRP levels toward any RAS site depending on the distance of the transmitter to the site.¹²² Aeronet has represented both in our record and to the Federal Agencies that their proposed system has the capability to automatically avoid transmission towards specified stationary areas or coordinates corresponding to RAS sites, which would enable them to comply with such a requirement.¹²³

47. We adopt an OOB limit of -29.7 dBW in any 100 megahertz of the passive band 86–92 GHz for air-to-air transmissions, as suggested by the Federal Agencies.¹²⁴ We also adopt a requirement that air-to-air transmissions, in both the 70 GHz and 80 GHz bands, not take place within the main beam of an RAS observatory, and that if this cannot be assured, no transmissions should take place within the radio horizon of the observatory. This restriction was also suggested by the Federal Agencies.¹²⁵ We adopt these requirements in order to protect passive services in the adjacent bands (i.e., 76–81 GHz, and above 86 GHz). The Federal Agencies' analysis uses ITU recommendations as their starting point, and comprehensively considers various factors that may influence both harmful interference from aeronautical operations specifically, and aggregate interference from those operations, in addition to previously authorized services.¹²⁶ Accordingly, we conclude that the resulting recommendations will be sufficient to protect EESS operations.

¹¹⁷ American Astronomical Society Comments at 2; CORF Comments at 2, MIT Haystack Observatory Comments at 1–2, NRAO Comments at 8.

¹¹⁸ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6056, para. 42.

¹¹⁹ American Astronomical Society Comments at 2; CORF Comments at 2; MIT Haystack Observatory Comments at 1–2; NRAO Comments at 8.

¹²⁰ CORF Comments at 2; World Meteorological Organization Reply Comments at 2.

¹²¹ CORF Comments at 2; NRAO Comments at 4.

¹²² Federal Agencies Letter, Attach. A at 1; *id.*, Attach. C at 1–2.

¹²³ Letter from Roger Sherman, Counsel to Aeronet Global Communications Inc., to Marlene H. Dortch, Secretary, FCC, WT 20-133 (filed July 19, 2023); Federal Agencies Letter, Attach. C at 1, fn. 1.

¹²⁴ Federal Agencies Letter, Attach. C at 1.

¹²⁵ *Id.*, Attach. B at 4–5; *id.*, Attach. C at 1–2. The list of RAS facilities will be specified in our rules, and may be found in App. A below. *See id.*, Attach. A at 2.

¹²⁶ *Id.*, Attach. B at 8–9.

48. We take protection of RAS operations very seriously, and accordingly assign significant weight to the concerns expressed in the record, and especially in the Federal Agencies' analysis, which discusses protection of RAS operations in detail.¹²⁷ In order to safeguard these operations, we will follow the recommendations of the Federal Agencies in requiring the following interference protection measures. First, as a general matter no transmissions may occur within the main beam of an RAS station.¹²⁸ In addition, aircraft within the radio horizon of any RAS station must limit the EIRP level towards the RAS stations of any air-to-air transmission, as set forth in Fig. 1.¹²⁹

Fig. 1: List of Maximum Allowable EIRP levels toward RAS sites, in dBW

Frequency (GHz)	Horizontal Distance (km)									
	150	175	200	225	250	275	300	325	350	375
81	-11.2	-8.8	-6.5	-4.2	-1.5	1.1	3.9	6.7	10	13.5
82	-11.5	-9.2	-6.9	-4.6	-2	0.5	3.2	6	9.2	12.6
83	-11.7	-9.5	-7.3	-5	-2.4	0	2.7	5.4	8.6	11.9
84	-11.9	-9.7	-7.5	-5.3	-2.8	-0.4	2.3	4.9	8	11.3
85	-12.1	-9.9	-7.8	-5.5	-3	-0.7	1.9	4.5	7.6	10.8
86	-12.2	-10	-7.9	-5.7	-3.3	-0.9	1.7	4.2	7.3	10.5

49. In addition to concerns regarding adjacent band services, the Federal Agencies also raised concerns about potential harmful interference to co-primary services in the 70 GHz band.¹³⁰ Protection of fixed point-to-point links, both federal and non-federal, is addressed below. For protection of Federal FSS operations, the Federal Agencies suggest that, similar to protections for RAS stations, EIRP levels from air-to-air transmissions within 375 km of a specified military installation should not exceed 20 dBW/1000 megahertz toward that installation, unless the aeronautical operator has coordinated some other allowable level with the Department of Defense.¹³¹ In response to the *Refresh Public Notice*, no commenter objects to these interference mitigations measures, nor argues that they are insufficient to protect co-primary services in the 70 GHz band. As with protections for RAS operations, we find the Federal Agencies' analysis on this point persuasive, particularly since no other commenter touches on the interest of Federal FSS operations. Accordingly, we adopt the suggested requirement that air-to-air transmitters within 375 km of any of the specified military installations¹³² must limit the EIRP of their transmissions to 20 dBW toward the military installation site.

50. *Altitude Restrictions.* In its petition for rulemaking, Aeronet specified that its proposed service would operate only with aircraft at altitudes between 10,000 and 50,000 feet.¹³³ We did not seek specific comment in the *70/80/90 GHz NPRM* on this point. DSA suggested that altitude restrictions are unnecessary because the risk of interference into other services is already low, while Loon argued against

¹²⁷ *Id.*, Attach. A at 1; *id.*, Attach. B at 1–6; *id.*, Attach. C at 1–2.

¹²⁸ See *id.*, Attach. B at 4; *id.*, Attach. C at 1. The list of RAS facilities will be specified in our rules, and may be found in Appendix A below. See *id.*, Attach. A at 2.

¹²⁹ See *id.*, Attach. B at 3.

¹³⁰ *Id.*, Attach. B at 9–11.

¹³¹ *Id.*, Attach. C at 2.

¹³² This list, which includes specific coordinates for each site, may be found in Appendix A at 47 CFR § 101.1528(c) below. See also Federal Agencies Letter, Attach. C at 5; Federal Agencies Clarification Letter at 2. The Department of Navy also seeks to add an additional FSS site in Miramar, CA, which is not currently reflected in US389, to the list of protected sites in our part 101 rules. Federal Agencies Clarification Letter at 2. We are not taking any action in this proceeding to modify US389, and thus defer on this request at this time.

¹³³ Aeronet Aeronautical Petition at 14.

any altitude caps on the theory that they would be harmful to potential competition.¹³⁴ Geneva Communications suggests that altitude restrictions are unnecessary so long as links are adequately and dynamically coordinated.¹³⁵ FWCC supports a restriction to between 10,000 and 50,000 feet of altitude.¹³⁶

51. We reject Loon’s assertion that altitude restrictions favor certain technologies or business models over others. The record demonstrates that, together with other restrictions, air-to-air transmissions between 10,000 and 50,000 feet may be accomplished without harmful interference to incumbent and adjacent operations; it does not demonstrate that transmissions at higher or lower altitudes would be similarly successful. As we are unpersuaded that mandating dynamic coordination of all air-to-air links is necessary, we reject Geneva Communications’ argument as well. Consistent with Aeronet’s petition, we adopt a minimum altitude of 10,000 feet for all air-to-air transmissions in these bands, and a maximum altitude of 50,000 feet. Together with the minimum slant path distance requirement that we also today adopt, these altitude restrictions will reduce the risk of harmful interference into other services by limiting the area on the ground with line of sight to the airborne transmitter, restricting the angle at which air-to-air transmissions may enter receivers on the ground, and setting a minimum vertical distance (and therefore a minimum amount of atmospheric attenuation) between air-to-air transmissions and both terrestrial and satellite services.

52. *Minimum Slant Path Distance.* In the *70/80/90 GHz NPRM*, we asked what mitigation measures might be necessary to address the risk of harmful interference from air-to-air transmissions between aircraft of significantly different altitudes.¹³⁷ That risk of interference arises from the resulting steep angle of the signal, and therefore the increased risk that the transmission ultimately illuminates a receiver in another service, especially a fixed point-to-point receiver along the boresight. Aeronet and Comsearch suggest that a minimum slant path distance would reduce any potential harmful interference from air-to-air links.¹³⁸ Qualcomm argues that a minimum horizontal distance between aircraft would be sufficient to render potential harmful interference into fixed links negligible.¹³⁹ No commenters argue against adopting a minimum separation between aircraft. Given the state of the record on this point, we adopt a minimum slant path distance of 50 kilometers between aircraft involved in air-to-air transmissions.

c. Transmissions Between Ships, Shore, and Aerostat Stations

53. The record generally supports technical and operational restrictions on transmissions to and from ship, shore, and aerostat stations that are parallel to those adopted for airborne transmissions.¹⁴⁰

¹³⁴ DSA Reply Comments at 5.

¹³⁵ Geneva HAPS Public Notice Reply Comments at 1–2.

¹³⁶ FWCC Comments at 6–7.

¹³⁷ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6057, para. 45.

¹³⁸ Aeronet Comments at 3; Comsearch Report at 28–32.

¹³⁹ Qualcomm HAPS Public Notice Comments at 8.

¹⁴⁰ Sceye Comments at 12 (“Sceye also supports the use of a unified light-licensing framework to allow fixed terrestrial, satellite, fixed aerostat, and aviation/maritime to register their respective 70/80/90 GHz links”); Comsearch Comments at 1–2; L3Harris May 18, 2021 *Ex Parte* at 1 (Aeronet’s proposed “deployment of SDDL technology will dramatically reduce network costs and provide enhanced security for . . . maritime operators”); Loon Comments at 2 (“Loon appreciates the importance of robust in-flight and maritime connectivity. . . . By adopting flexible, technology-neutral rules and setting a path toward dynamic coordination for all services in the bands, the Commission can ensure simultaneous technological innovation on land, at sea, in the sky, and in space.”); WISPA Comments at 7 (“In general, the services contemplating fixed transmissions to moving terminals in . . . maritime environments should pose a low risk of interference to more conventional fixed uses.”); FWCC Comments at 2 (“the FWCC has no objection to Aeronet’s proposal to operate a mobile aviation and maritime communications network, provided the Commission protects incumbent users” (internal citations omitted)); DSA Comments at 4 (“[W]e see no technical reason why the 70/80 GHz database could not serve as a comprehensive repository of all non-federal

(continued....)

Shore-to-ship transmissions are only permitted in the 70 GHz band, and ship-to-shore transmissions are only permitted in the 80 GHz band. Shore-to-aerostat transmissions and aerostat-to-ship transmissions are only permitted in the 70 GHz band. Aerostat-to-shore transmissions are only permitted in the 80 GHz band. We adopt an OOB limit of -29.7 dBW in any 100 megahertz of the passive band 86–92 GHz for ship-to-shore and aerostat-to-shore transmissions in order to protect EESS (passive) operations.¹⁴¹

54. Ship-to-ship communications are limited to ships located more than 30 km offshore, or closer only where the main beam of the transmit antenna is oriented at least 15 degrees away from any point on the shore. Ship stations and aerostat stations must only operate when there is a minimum separation of 150 km to the federal facilities listed in section 101.1528(c)(1) – Table 1 in Appendix A in this *Report and Order*, absent a coordination agreement with the federal operator. Shore-to-ship, shore-to-aerostat, aerostat-to-shore, and ship-to-shore transmission must only occur between stations that are located at least 10 km from the federal military installations listed in section 101.1528(c)(2) – Table 2 in Appendix A in this *Report and Order*, absent a coordination agreement with the federal operator. Ship-to-shore, shore-to-ship, shore-to-aerostat, aerostat-to-ship, and aerostat-to-shore operations must coordinate with Federal FS operations using the NTIA web-based coordination mechanism to prevent interference.¹⁴² We note that ship-to-aerostat operation has not been sufficiently studied, and thus is not permitted at this time, although we seek comment in the *Further Notice* below on its potential implementation. Aeronet, through filings submitted in the record, has outlined the important role of bidirectional transmissions between ships and aerostats to the two-way maritime broadband services otherwise authorized in this *Report and Order*.¹⁴³ During the pendency of the *Further Notice*, WTB will consider requests for waiver with respect to specific ship-to-aerostat implementation deployment proposals through our existing regulatory processes,¹⁴⁴ subject to coordination with NTIA to ensure that federal incumbents are protected from harmful interference and coordination with any other potentially impacted parties.

55. The same engineering principles that underpin our adoption of technical and operational restrictions for transmissions between aircraft and ground stations and aircraft in flight serve as a baseline in the maritime context as well, subject to certain modifications as set forth herein and in Appendix A in this *Report and Order*.¹⁴⁵ Opponents of transmissions between ships, shore, and aerostat stations predominantly assert the need for further examination of whether incumbent or future operations in the bands might suffer interference from by maritime operations.¹⁴⁶ The exhaustive TIG process led by the

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links, whether they are traditional fixed point-to-point links; links to, from, and between antennas in motion on ships or aircraft . . .”). See also SIA Comments at 7 (“Maritime operations do not pose the same risk to co-primary users of the 70, 80, and 90 GHz bands . . . because the characteristics of maritime operations are not like those of aeronautical operations.”). But see SIA Comments at 7–8 (“Nevertheless, to the extent the FCC decides to authorize maritime uses of these bands, it should take appropriate steps to integrate those uses into the current regulatory regime, including ensuring that interference issues are addressed in a way that does not have an unnecessary impact on other users.”).

¹⁴¹ See *supra* paras. 46–47.

¹⁴² See *supra* para. 23.

¹⁴³ See Letter from Roger Sherman, Counsel to Aeronet Global Communications Inc., to Marlene H. Dortch, Secretary, FCC, WT 20-133 (filed Jan. 19, 2024) (Aeronet Jan. 19, 2024 *Ex Parte*); Comsearch Report at Section 3.2.3, 20, 43–44; see generally Aeronet Maritime Petition at 10–11, 13 & Figure 1, 17, 18 & Figure 2.

¹⁴⁴ 47 CFR § 1.925(b)(3). See *supra* note 111.

¹⁴⁵ For example, we clarify that Appendix A does not establish a minimum elevation angle in the maritime context. See Aeronet Jan. 10, 2024 *Ex Parte* at 2.

¹⁴⁶ See, e.g., T-Mobile Comments at 4–5 & n.14 (“maritime use of the 70 GHz and 80 GHz bands should not preclude existing and future point-to-point use of the bands”); Verizon Comments at 8 (“[T]he Commission should delay acting on its proposal to authorize point-to-point links to endpoints in motion until it determines whether

(continued....)

Federal Agencies provides the requested examination.¹⁴⁷ Each of the restrictions described above finds specific support in the collective Federal Agencies Letter, reflecting extensive interagency collaboration—collaboration focused in part on ensuring non-interference with current and future uses of the bands in question—as promised by the Commission in the *70/80/90 GHz NPRM*.¹⁴⁸ No parties objected to adopting the proposed maritime regime we describe above following the solicitation of comment on the Federal Agencies Letter in our *Refresh Public Notice*.¹⁴⁹ We find that the combination of the: (1) Commission’s own engineering expertise; (2) initial general support for a maritime regime found in responses to the *70/80/90 GHz NPRM*; (3) further examination of specific analyses undertaken in the Federal Agencies Letter, and the studies underpinning it; and (4) silence on maritime issues in particular in the *Refresh Public Notice* comment cycle, demonstrate that the above-described regime for transmissions between ships, shore, and aerostats will protect current and future operations both in the 70 GHz and 80 GHz bands, and in adjacent bands.

B. Facilitating Use of the Bands for Backhaul

56. To promote more intensive use of spectrum in the 70 GHz and 80 GHz bands, including use for backhaul for high-capacity 5G service, we adopt several changes to our antenna standards that will allow licensees to use smaller, lower-cost antennas in these bands, and we adopt a channelization plan for the band.

57. *Antenna Standards.* The *70/80/90 GHz NPRM* proposed several changes to the antenna standards for the 70 and 80 GHz band to promote flexibility. In particular, the *70/80/90 GHz NPRM* proposed to reduce minimum antenna gain from 43 dBi to 38 dBi while retaining the requirement to proportionally reduce maximum EIRP in a ratio of 2 dB of power per 1 dB of gain. It also proposed to reduce the co-polar and cross-polar discrimination requirements applicable to 70 GHz and 80 GHz band antennas. Further, the *70/80/90 GHz NPRM* sought comment on whether to allow +/- 45 degree polarization (also known as slant polarization) and whether to adopt a second, more flexible set of antenna standards in these bands. Commenters generally supported reducing antenna gain and co-polar and cross-polar discrimination requirements.

58. Although the Commission does not regulate the size of antennas directly, minimum antenna size is constrained by technical factors including the intended operating bands and requirements governing beamwidth, gain, and polarization discrimination. Based on our analysis of the record, we determine to relax those requirements for the 70 GHz and 80 GHz bands to standards more in line with the requirements for point-to-point operations for other part 101 bands. We acknowledge Fiberless Networks’ concern that “[a]ny reduction in antenna sizes must ultimately impact the number of wireless links using the 71–76 and 81–86 GHz bands that may be deployed in any metro area,”¹⁵⁰ but we are

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mobile aeronautical and maritime deployments pose an interference risk to use of the band for fixed wireless 5G backhaul.”); Nokia Comments at 8–9 (“Nokia recommends that this new service [referencing both mobile aerial and maritime endpoints] not be added at this time, but we would not oppose testing of such services for potential inclusion on a non-interference basis at a later date subject to successful co-existence trials”); Moog Comments at 8 (stating that “without knowing if there will be restraints on the location and orientation of land stations using SDDLs, whether maritime or aviation . . . there is potential for interference to other co-band operations at airfields that might fall within the changing pointing direction of SDDL land station transmitters”). *See also* SIA Comments at 7–8.

¹⁴⁷ Federal Agencies Letter at 1–2; *see also id.*, Attach. B; *id.*, Attach. C.

¹⁴⁸ *Id.* at 1–2; *id.*, Attach. B; *70/80/90 GHz NPRM*, 35 FCC Rcd at 6040, para. 1; *id.* at 6055–52, paras. 40, 42–45.

¹⁴⁹ While a small number of filers did call for the Commission to prioritize certain services over others—*see, e.g.*, CTIA Refresh Public Notice Comments at 3–5; AT&T Refresh Public Notice Comments at 3–4—we address these filings in Section III.D, *infra*.

¹⁵⁰ Fiberless Networks Corporation Comments at 12.

persuaded by the FWCC's long-stated advocacy that such changes "will allow for the use of smaller, lighter, lower cost, less susceptible to pole sway, and more visually attractive antennas" that may enable more intensive use of the 70 GHz and 80 GHz bands for point-to-point backhaul services.¹⁵¹ Additionally, commenters agree that relaxing these antenna standards will also enable the use of smaller antennas for backhaul that will be needed to facilitate densified 5G networks.¹⁵² Accordingly, we raise the maximum beamwidth to 2.2 degrees and reduce the minimum antenna gain to 38 dBi for antennas in the 70 GHz and 80 GHz bands.¹⁵³ In order to maintain consistency and minimize the risk of interference, the proportional power reduction requirement will continue to be applicable to antennas in these bands with a gain less than 50 dBi down to the new minimum antenna gain of 38 dBi.¹⁵⁴

59. We also adopt our proposal to remove the co-polar discrimination requirement below 5 degrees and modify the cross-polar discrimination requirements below 5 degrees to 21 dB.¹⁵⁵ Some commenters argue that both the co-polar and cross-polar discrimination requirements are obsolete and propose eliminating those requirements entirely.¹⁵⁶ FWCC contends that some of the smaller, lighter antennas its members contemplate using cannot meet the existing co-polar requirement.¹⁵⁷ In order to maximize the flexibility we seek to achieve by relaxing the antenna standards, we eliminate the co-polar discrimination requirement at angles less than 5 degrees. However, we decline to eliminate the cross-polar discrimination requirements below 5 degrees in their entirety. We agree with commenters, including the third-party database manager Comsearch, that cross-polar discrimination requirements are proven to be effective in maximizing frequency reuse in the 70 GHz and 80 GHz bands.¹⁵⁸ The Commission agrees with Comsearch that reducing the cross-polar discrimination requirement for angles less than 5 degrees to 21 dB brings our rules closer to conformity with international standards without sacrificing the frequency reuse advantages of having some cross-polar requirement.¹⁵⁹ We agree with Comsearch that a cross-polar discrimination requirement of 21 dB is not "difficult to meet[.]"¹⁶⁰

60. Further, we adopt corresponding changes to the co-polar and cross-polar discrimination requirements at angles between 5 degrees and 180 degrees. Physics dictates that smaller antennas will

¹⁵¹ Letter from Donald J. Evans, Counsel to FWCC, to Marlene H. Dortch, Secretary, FCC (filed June 10, 2021); *see also* FWCC Refresh Public Notice Comments at 1–3; CTIA Refresh Public Notice Comments at 6–9.

¹⁵² *See, e.g.*, Nokia Comments at 1; 5G Americas Comments at 2; Verizon Comments at 1; FWCC Comments at 3; T-Mobile Comments at 3; Letter from Kara Graves, Assistant Vice President, Regulatory Affairs, CTIA, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed May 8, 2020).

¹⁵³ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6045–46, para. 11. *See also* 47 CFR § 101.115(b)(2). Some parties suggested that the Commission go further and adopt a minimum antenna gain of 35 dBi or lower. *See, e.g.*, Qualcomm Comments at 7–8.

¹⁵⁴ *See, e.g.*, Comsearch Reply Comments at 1. *See also* 47 CFR § 101.115(b)(2) n.14. Lower-gain antennas have more energy in their sidelobes as compared to a higher-performance antenna, so imposing a proportional reduction in EIRP for antennas with a gain less than 50 dB helps to compensate for the additional power in the sidelobes—thereby ensuring that a lower-performance antenna does not create any greater risk of off-axis interference than a higher-performance antenna.

¹⁵⁵ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6046, para. 12. *See also* 47 CFR § 101.115(b)(2) n.14.

¹⁵⁶ *See, e.g.*, Verizon Comments at 5–6.

¹⁵⁷ FWCC Comments at 2 n.3 (enumerating past advocacy by FWCC, including on this issue).

¹⁵⁸ Comsearch Reply Comments at 3.

¹⁵⁹ *Id.* *See also* European Telecommunications Standards Institute (ETSI), Standard ETSI EN 302 217-4-2 (V1.5.1), "Fixed Radio Systems; Characteristics and Requirements for Point-to-Point Equipment and Antennas" (2010), https://www.etsi.org/deliver/etsi_en/302200_302299/3022170402/01.05.01_60/en_3022170402v010501p.pdf (ETSI Standard).

¹⁶⁰ *See* Comsearch Reply Comments at 3–4.

have less sidelobe suppression. Therefore, corresponding adjustments to the discrimination requirements between 5 and 180 degrees are also necessary to facilitate the use of smaller antennas. FWCC proposed antenna standards for this band that are consistent with our proposed minimum gain of 38 dBi and maximum beamwidth of 2.2 degrees and also proposed co-polar and cross-polar discrimination values for angles between 5 degrees and 180 degrees.¹⁶¹ FWCC's proposals are consistent with ETSI Class 3 antenna standards,¹⁶² and are supported by the 5G Wireless Backhaul Advocates¹⁶³ and Comsearch.¹⁶⁴ Comsearch emphasizes that it is appropriate to provide antenna performance requirements between 5 and 180 degrees, as proposed by FWCC.¹⁶⁵ We believe that the changes proposed by FWCC and the 5G Backhaul Advocates strike a balance, allowing for the use of smaller antennas which will promote and expedite backhaul deployment,¹⁶⁶ while also preserving an appropriate co-polar and cross-polar advantage between paths to promote frequency re-use.¹⁶⁷

61. In the *70/80/90 GHz NPRM*, we sought comment on a proposal to allow +/- 45 degree polarization (slant polarization) in the 70 GHz and 80 GHz bands.¹⁶⁸ At this time, we decline to modify our rules to adopt slant polarization because we agree with most commenters that slant polarization will increase the risk of interference and make the coordination of links more difficult.¹⁶⁹ As Comsearch notes, allowing slant polarization would "take away the cross-polarization advantage between paths" which has "proven to be effective in maximizing frequency reuse in the 70 and 80 GHz bands . . .".¹⁷⁰

62. We also decline to adopt a second category of antenna standards for the 70 GHz and 80 GHz bands. The Commission's rules for some other services regulated under part 101 allow for two categories of antennas, Category A and Category B; Category A performance standards are more stringent than Category B.¹⁷¹ In the *70/80/90 GHz NPRM*, we sought comment on whether to adopt a similar framework for the 70 GHz and 80 GHz bands by designating the existing antenna standards the "Category A" standards and adopting new, less restrictive "Category B" standards.¹⁷² Although some commenters, including Scientel Solutions and T-Mobile, support adding a Category B standard that does

¹⁶¹ See FWCC Comments at 6, WT Docket No. 10-153 (rec. Oct. 5, 2012).

¹⁶² See ETSI Standard.

¹⁶³ See Letter from Jeffrey A. Marks, Vice President, Regulatory Affairs, North America, Nokia, to Marlene H. Dortch, Secretary, FCC, WT 20-133, at 12 (filed June 22, 2021).

¹⁶⁴ See Comsearch Comments at 7-9.

¹⁶⁵ See Comsearch Reply Comments at 2-3.

¹⁶⁶ See, e.g., Nokia Comments at 2; AT&T Comments at 4.

¹⁶⁷ See Comsearch Reply Comments at 3-4.

¹⁶⁸ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6046-47, para. 13.

¹⁶⁹ See, e.g., Nokia Comments at 5; AT&T Comments at 2; Ericsson Comments at 7; Comsearch Comments at 10; AT&T Refresh Public Notice Comments at 2-3.

¹⁷⁰ Comsearch Reply Comments at 3 ("In instances where there are multiple links between the same two structures, using the opposite polarization assists with frequency reuse.").

¹⁷¹ See 47 CFR § 101.115(b); see also *Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Services and Operational Fixed Microwave Licensees, et al.*, Second Report and Order, Second Further Notice of Proposed Rulemaking, Second Notice of Inquiry, Order on Reconsideration, and Memorandum Opinion and Order, 27 FCC Rcd 9735, 9741, para. 9 (2012). Category B antennas may be used in areas not subject to frequency congestion. 47 CFR § 101.115(b). Category B antennas must be replaced if they are shown to cause interference to (or receive interference from) any other authorized station where a higher performance antenna is not likely to cause such interference. *Id.* § 101.115(c).

¹⁷² *70/80/90 GHz NPRM*, 35 FCC Rcd at 6047, para. 14.

not exist for these bands in the current rules, others, including 5G Americas, Ericsson, and Nokia, do not believe a Category B standard is necessary.¹⁷³ Comsearch argues that there is no reason to define two categories of antennas because database managers would not be able to compel antenna upgrades based on predicted interference. We also agree with commenters that adding a Category B standard is unnecessary, given our decision in this *Report and Order* to allow smaller antennas in these bands.¹⁷⁴

63. *Channelization Plan.* The *70/80/90 GHz NPRM* sought comment on whether adopting a channelization plan would promote more efficient use of the 70 GHz and 80 GHz bands.¹⁷⁵ It further asked about what channel plan should be considered, noting the existence of the plan contained in ITU Recommendation F.2006, which we describe in greater detail below.¹⁷⁶ The *70/80/90 GHz NPRM* also solicited comment on a range of issues including the impact of a channel plan on existing equipment, whether to continue to apply the standard emission limit rules in section 101.1011, whether any specific channel plan and direction of service would be particularly conducive to protecting the other co-primary services from interference, and the costs and benefits of channelization.¹⁷⁷

64. We are persuaded that we should adopt a channelization plan consistent with Recommendation ITU-R F.2006.¹⁷⁸ We acknowledge that the Commission decided in 2003 that a specific channel plan was unnecessary in the context of adopting new rules to facilitate greater use of the bands by nascent fixed services.¹⁷⁹ Given the development of these fixed services since 2003 and our adoption today of rules to permit additional services into the band, we agree with commenters that a standardized channel plan will make interference mitigation between licensees easier to manage. Adopting the ITU F.2006 plan will also harmonize our rules with international standards, and is consistent with a majority of commenters' recommendations.¹⁸⁰

65. After reviewing the record, including responses to the *HAPS Public Notice* and *Refresh Public Notice*, while some commenters are neutral on the issue of channelization others specifically state that if the Commission introduces new services into the band—such as the services contemplated by Aeronet—there will be a greater need to have a standardized channel plan in order to make interference mitigation between licensees more manageable.¹⁸¹ On balance, most commenters support adopting a

¹⁷³ Compare Scientel Comments at 6; T-Mobile Comments at 6–7 (arguing that less restrictive Category B standards would further promote deployment); with 5G Americas Comments at 6; Ericsson Comments at 8; Nokia Comments at 6 (arguing that relaxing the current standard is sufficient and adopting a second standard is unnecessary).

¹⁷⁴ See Nokia Comments at 2 (“Nokia believes that a ‘Class B’ antenna category in the 70/80 GHz band would have limited utility in the near-term because of the already very-small size of the proposed 38 dBi antennas in the 70/80 GHz band compared to the larger antennas used in other bands.”).

¹⁷⁵ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6058–59, paras. 46–48.

¹⁷⁶ *Id.* at 6058–59, para. 46, n.129. See also International Telecommunications Union (ITU), Recommendation ITU-R F.2006, “Radio-Frequency Channel and Block Arrangements for Fixed Wireless Systems Operating in the 71–76 and 81–86 GHz Bands” (2012), https://www.itu.int/dms_pubrec/itu-r/rec/f/R-REC-F.2006-0-201203-1!!PDF-E.pdf (ITU Recommendation).

¹⁷⁷ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6058–59, paras. 46–48.

¹⁷⁸ See ITU Recommendation.

¹⁷⁹ *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23333, para. 32; see also *Allocations and Service Rules for the 71–76 GHz, 81–86 GHz, and 92–95 GHz Bands*, WT Docket No. 02-146, Memorandum Opinion and Order, 20 FCC Rcd 4889, 4899–90, paras. 19–20 (2005) (*70/80/90 GHz Reconsideration Order*). See generally *Allocations and Service Rules for the 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, RM-10288, Notice of Proposed Rulemaking, 17 FCC Rcd 12182, 12220, para. 97 (2002).

¹⁸⁰ See Geneva Communications Comments at 11; Ericsson Comments at 9–10; AT&T Comments at 3; Nokia Comments at 7–8; AT&T Refresh Public Notice Comments at 4.

¹⁸¹ CORF Comments at 2; Qualcomm Comments at 12.

standardized plan specifically if new services are introduced into the band.¹⁸² Moreover, Aeronet supports the adoption of a standardized channel plan.¹⁸³

66. There is near-unanimous agreement among commenters that if the Commission adopts a channel plan, we should adopt a plan consistent with Recommendation ITU-R F.2006, which provides different channel sizes from 250 megahertz up to 5 gigahertz, and includes a plan for 1.25 gigahertz segmentation.¹⁸⁴ This channelization plan is consistent with what the Commission proposed, but ultimately did not codify in the original 70–80 GHz rulemaking. Comsearch notes that a majority of licensees already conform with the ITU-R F.2006 channel plan.¹⁸⁵ Even commenters that advocate against adopting a standardized channel plan, such as WISPA, support adopting the ITU F.2006 channel plan if the Commission decides that it should adopt a standardized plan.¹⁸⁶

67. To provide adequate lead time for manufacturers to modify their equipment lines to comply with the new channel plan,¹⁸⁷ we will make the new channel plan effective on September 1, 2024. Considering that there are incumbents in the band who have deployed under the current rules and may not be operating consistent with a channel plan that we adopt, we will permit licensees that are registered prior to the effective date of the new channel plan to continue to operate under nonconforming channel plans as long as their pre-existing operations remain in good standing. With the exception of de minimis modifications to registered links discussed below,¹⁸⁸ all links registered on or after September 1, 2024 will be required to comply with the new channel plan.

C. Improving the Link Registration System

68. In the *70/80/90 GHz NPRM*, the Commission solicited input on whether it should make changes to the link registration rules for the 70/80/90 GHz bands.¹⁸⁹ Specifically, the Commission sought comment on how to amend its rules to improve the accuracy of the link registration database.¹⁹⁰ The Commission also asked whether it should require licensees in these bands to certify that their links have been timely constructed—and, if so, how an efficient and effective certification process would operate.¹⁹¹ The Commission also sought comment on whether to allow de minimis modifications to certain information filed in the registration database.¹⁹²

¹⁸² See 5 U.S.C. § 801(a)(1)(A).

¹⁸³ Aeronet Comments at 22.

¹⁸⁴ Loon Reply Comments at 21–22; Geneva Communications Comments at 11–12.

¹⁸⁵ See Comsearch Comments at 18.

¹⁸⁶ WISPA Reply Comments at 7–8.

¹⁸⁷ See CTIA Reply Comments at 4; AT&T Comments at 6.

¹⁸⁸ See *infra* Section III.C.2 (“De Minimis Modifications to Registrations”).

¹⁸⁹ The 90 GHz band has different antenna rules, but the same link registration process as the 70 GHz and 80 GHz bands. Although in this *Report and Order* we do not modify the antenna rules in the 90 GHz band, in our consideration of changes to the link registration process, we do include the 90 GHz band to maintain a harmonized approach to link registration for all of the bands included in the link registration system. See 47 CFR §§ 101.115(b), 101.1523.

¹⁹⁰ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6048, para. 18.

¹⁹¹ *Id.* at 6048–49, para. 19. Among other things, the Commission asked whether “certifications should be filed when the links become operational, at any time prior to the construction deadline, or whenever a licensee seeks to renew its license?” *Id.*

¹⁹² *Id.* at 6049, para. 21.

1. Construction and Operational Status

69. To promote the efficient use of the high-capacity 70/80/90 GHz bands, in this *Report and Order* we adopt a requirement that licensees certify that each link is constructed and operating within 12 months of successful registration in the link registration system (LRS) administered by third-party database managers. Under the Commission's rules in place since 2003, licensees must construct their links within 12 months of registering them in the LRS and failure to timely begin operation means the authorization cancels automatically.¹⁹³ Under the hybrid license/registration approach adopted for these bands, however, the Commission decided "at [that] time" not to require licensees to affirmatively report link construction and instead relied on licensees to ask a database manager to remove unconstructed links from the database.¹⁹⁴ As such, the Commission instructed the database managers to remove a link from the registry if it is found to be unconstructed after the required timeframe.¹⁹⁵ We note that in 2003 the bands were "essentially undeveloped and available for new uses" and that the Commission reserved the discretion to revisit this issue if experience indicated that additional measures were necessary.¹⁹⁶

70. Today, as in 2003, the overarching purpose of the Commission's requirements concerning link construction, as well as modification and discontinuance, is to ensure that spectrum is put to use and to maintain the "integrity of the information in the relevant databases by correctly reflecting the actual record concerning these issues."¹⁹⁷ Based on the Commission's experience, including the development of the bands since 2003, and the record before us, we find that requiring licensees to certify in the LRS that each link is timely constructed will significantly improve the accuracy of the database, thereby increasing opportunities for additional, efficient use of the bands. Failure to begin operations in a timely manner pursuant to a part 101 authorization results in the automatic cancelation of an authorization.¹⁹⁸

71. In the 70/80/90 GHz bands, the nationwide license serves as a prerequisite to registering links, each registration in the LRS is the licensee's authorization to operate the individual link,¹⁹⁹ and the 12-month construction period commences on the registration date of each individual link.²⁰⁰ Under the current rules, "[f]ailure to timely begin operation means the authorization cancels automatically" as of the construction deadline.²⁰¹ Similar to the timeline for construction notifications filed in ULS, however, we will allow 70/80/90 GHz licensees 15 days after the 12-month construction deadline for each link to certify in the LRS that the link was timely constructed and operating.²⁰² Accordingly, if a 70/80/90 GHz licensee does not certify in the LRS within 15 days after the 12-month construction deadline for a link,

¹⁹³ See 47 CFR § 101.63(b), (c).

¹⁹⁴ *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23349, para. 80.

¹⁹⁵ See *id.* at 23349, para. 80.

¹⁹⁶ See *id.* at 23322, 23349, paras. 5, 80.

¹⁹⁷ *Id.* at 23351, para. 80.

¹⁹⁸ 47 CFR § 101.63(c).

¹⁹⁹ See *id.* § 101.1501; *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23340, para. 46 (Commission explained that applicant-qualification for non-exclusive licenses would be assessed on FCC Form 601 and Commission rules while operations would be authorized through the registration and coordination process).

²⁰⁰ 47 CFR § 101.63(b). Because 70/80/90 GHz links are registered in the LRS, the provision in paragraph (f) stating that "construction of any authorized facility or frequency must be completed by the date specified in the license" is inapplicable to 70/80/90 links.

²⁰¹ *Id.* § 101.63(c).

²⁰² See *id.* § 1.946(d) ("A licensee who commences service or operations within the construction period . . . must notify the Commission by filing FCC Form 601. The notification must be filed within 15 days of the expiration of the applicable construction . . . period.").

the link will be deemed to be unconstructed and the licensee's authority to operate the link shall be terminated automatically without further Commission action as of the 12-month construction deadline for the link. We also agree with commenters that after the certification requirement becomes effective, it should apply to all uncertified links even if the 12-month construction deadline date occurred prior to the effective date of the certification requirement. For uncertified links registered 12 months or longer before the effective date, licensees will have until 15 days after the effective date to certify that their links were constructed on or before the effective date. Thus, for uncertified links registered less than 12 months before the effective date, licensees will have to file a certification within 15 days from the end of the 12-month construction period following registration.

72. Once the certification requirement is in effect, we instruct the third-party database managers, as a matter of database accuracy and integrity, to remove uncertified registrations from the LRS that have terminated automatically under the Commission's rules. Because licensees will have until 15 days after the 12-month construction deadline to certify in the LRS that a link is constructed and operating, we instruct database managers to remove a link from the LRS on the 16th day after the 12-month construction deadline for a link if the licensee has not certified in the LRS that the link was timely constructed and operating.

73. Imposing the certification requirement on licensees and having the third-party database managers update the LRS accordingly will allow all licensees, and the Commission, to track link cancellations through the LRS. Parties considering the 70/80/90 GHz bands and licensees seeking to register links after implementation of this requirement will have a more accurate database to use to judge spectrum availability.²⁰³

74. There is broad support in the record for implementing the certification requirement. FWCC argues that construction certifications will help maintain a reliable database at a low cost to licensees.²⁰⁴ Commenters broadly agree that the database should consist only of links that are actually constructed or that have been successfully registered but are within their one-year construction period, and that requiring construction certifications would be an effective way to maintain an accurate database and promote efficient access to the bands.²⁰⁵ Other commenters, including Comsearch, agree that the existing database managers are well suited to administer the certification requirement.²⁰⁶

75. Although some parties would have the Commission manage construction certifications through ULS, we believe that the hybrid license/registration approach that has governed these bands since the database managers developed and began operating the LRS in 2005 has worked reasonably well and should not be displaced.²⁰⁷ Industry members are already accustomed to working with the database managers on spectrum management matters and have established access to the database managers' platforms. The Commission agrees with FWCC and Comsearch that using ULS for certification would add unnecessary complexity to the link registration process.²⁰⁸ We agree, however, with commenters who

²⁰³ In this setting, if a licensee's authority to operate a link is automatically terminated because the construction requirement was not met, the licensee will not be barred from attempting to register the link again, and if successful, constructing it later. The licensee, however, will lose the original registration date for the purpose of interference protection procedures.

²⁰⁴ FWCC Comments at 5.

²⁰⁵ See, e.g., AT&T Comments at 6; Geneva Communications Comments at 6; WISPA Comments at 6.

²⁰⁶ See FWCC Comments at 6; Comsearch Reply Comments at 5. Micronet's database provides information about links that have been registered and not constructed, but there is no requirement that Micronet provide this information and there is no requirement that licensees inform Micronet when links are built. Therefore, links that appear in Micronet's database as unconstructed may be constructed. See Micronet Database, <https://www.micronetcom.com/MOS/>.

²⁰⁷ CTIA Comments at 6; Scientel Comments at 14.

²⁰⁸ See FWCC Comments at 6; Comsearch Reply Comments at 5.

suggest that additional measures are warranted to ensure that registered links remain operational on an ongoing basis long after satisfaction of the 12-month construction deadline.²⁰⁹ Accordingly, when a 70/80/90 GHz band licensee seeks to renew its nationwide license, we will require the licensee to certify as part of the license renewal application that each link registered under the license more than twelve months prior to the filing date of the renewal application is constructed and operating on an ongoing basis as of the filing date of the license renewal application. We disagree with AT&T that requiring licensees to certify every ten years that they are still operating their registered links is unnecessary given that we are requiring licensees to certify each link shortly after the 12-month construction deadline.²¹⁰ We clarify, however, that we are not requiring renewal applicants to “list links, whether constructed or not, in renewal applications for 70/80/90 GHz licenses.”²¹¹

76. *Implementation Matters.* We authorize and direct WTB to consult each database manager on the timing of modifications to the LRS necessary to accommodate today’s rule changes.²¹² WTB will also announce by public notice the details and dates for implementing a construction certification requirement. Additionally, we understand that each database manager periodically sends its registrants e-mail reminders of their upcoming and recently past construction deadlines and that each database manager plans to send e-mail alerts to its relevant registrants about these rule changes. We applaud the database managers’ past efforts to improve the accuracy of the database and encourage them to continue sending e-mail alerts to licensees. We emphasize, however, that each licensee is responsible for timely filing its construction certifications in the LRS regardless of whether a courtesy reminder e-mail may have been sent or received.²¹³ Finally, we remind licensees that they should only certify as constructed links that are operational, and that non-operational links should be deleted from the database.²¹⁴

²⁰⁹ See, e.g., Verizon Comments at 7 (incumbent licensees must certify that their links have been constructed at the time of renewal and all registrations must certify that their links are in regular use at the time of renewal); Geneva Communications Comments at 8 (links in the database that are no longer operational should be deleted); Scientel Comments at 14–16 (no need to wait until license renewal to require a licensee to certify that it is making efficient use of its spectrum, but favors requiring such certifications to be filed in ULS). But see AT&T Comments at 2–3 (adopting requirements that are novel, such as identifying or certifying links at license renewal, would merely impose unnecessary burdens, uncertainty and delays).

²¹⁰ AT&T Comments at 2–3, 7.

²¹¹ *Id.* at 7.

²¹² See generally Comsearch Comments at 12 (Comsearch supports rule changes to “improve[] processes for removing old registrations, unconstructed links, or links that are no longer operating from the 70/80/90 GHz bands database The Commission, however, would need to provide adequate notice of the new certification requirement to third-party database managers, as Comsearch would need to implement minor changes to its link registration system to add a page with appropriate language that the licensee can certify that the link is constructed.”).

²¹³ *Accord Biennial Regulatory Review—Amendment of Parts 0, 1, 13, 22, 24, 26, 27, 80, 87, 90, 95, 97, and 101 of the Commission’s Rules to Facilitate the Development and Use of the Universal Licensing System in the Wireless Telecommunications Services*, Report and Order, WT Docket No. 98-20, 13 FCC Rcd 21027, 21071, para. 96 (1998) (although the Commission sends letters to remind licensees of pending expiration dates, the renewal reminder is merely a courtesy and non-receipt by the licensee is not sufficient justification for a failure to file a timely renewal application). See generally FCC, *Construction/Coverage Requirements* (Sept. 29 2023), <https://www.fcc.gov/constructioncoverage-requirements>; FCC, *ULS Automated Termination Process Frequently Asked Questions* (Oct. 4, 2016), <https://www.fcc.gov/wireless/support/universal-licensing-system-uls-resources/uls-automated-termination-process>.

²¹⁴ Licensees are reminded that links that are not actually constructed by the construction deadline cancel automatically on the date of the construction period expires and are not entitled to first-in-time protection regardless of whether they may appear in the registration database. 47 CFR § 1.946(c).

2. De Minimis Modifications to Registrations

77. The 70/80/90 GHz NPRM sought comment on whether licensees should be allowed to amend their registered links without losing first-in-time status—i.e., on what date should a link be considered registered and given protected status for purposes of these rule—and what amendments, if any, should be allowed without losing first-in-time status.²¹⁵ We find support in the record for allowing de minimis modifications to registrations that are exclusively for the purpose of repairing or replacing installed and operating equipment, provided that there are no changes to any registered technical parameters that would change the potential for a link to cause or receive interference.²¹⁶ Modifications that are consistent with these requirements can be implemented without affecting a registrant's first-in-time rights for the particular link. Such modifications may be implemented if the modified registration is successful without affecting a registrant's first-in-time rights for the particular link. By allowing these de minimis modifications to registrations without changing the interference-protection date, we allow licensees to maintain the existing operation of their links without sacrificing either the accuracy of the database or the licensee's interference-protection rights.²¹⁷ We emphasize that “de minimis” modifications to registrations that commenters discuss in this proceeding are distinct from the Commission's part 1 rules that govern major or minor modifications to station authorizations.²¹⁸ To avoid confusion, we refer to modifications to registrations that licensees can make without losing first-in-time status as de minimis. Most parties support de minimis modifications to the extent that they will not change the interference landscape, though parties' ideas of what would constitute a de minimis modification differ.²¹⁹ Some parties argue that de minimis modifications should include changes to some technical specifications.²²⁰ For example, WISPA argues that minor modifications should include changes to geographic coordinates within +/- 15 meters of latitude or longitude and +/- 3 meters of elevation.²²¹ Others, however, believe that de minimis modifications should be only those changes that do not affect any technical parameters relevant for coordination.²²² We agree with commenters that modifications that change “interference potential” should not be treated as de minimis modifications and will result in a new date for first-in-time purposes.²²³

78. We find that many of the proposals by commenters, such as those involving changes to location, could change the interference landscape and therefor are not de minimis.²²⁴ In addition, changes

²¹⁵ 70/80/90 GHz NPRM, 35 FCC Rcd at 6049, para. 21.

²¹⁶ Comsearch Reply Comments at 9 (quoting Scientel Comments at 14–15, and agreeing that “a licensee should be allowed to amend the associated link registration without losing its first-in-time priority rights, provided that the amendment is submitted for purpose of repairing or replacing installed and operating equipment due to end-of-life conditions, and does not change the registered EIRP, transmit power, frequency, antenna height or location, or receive sensitivity”).

²¹⁷ See SIA Comments at 3.

²¹⁸ See 47 CFR § 1.947 (“Modification of licenses”), which cross-references to 47 CFR § 1.929 (“Classification of filings as major or minor”).

²¹⁹ See e.g., AT&T Comments at 2; Geneva Communications Comments at 10; Scientel Comments at 10; T-Mobile Comments at 9; SIA Comments at 3; WISPA Comments at 6; Comsearch Reply Comments at 7.

²²⁰ See, e.g., Geneva Communications Comments at 10; WISPA Comments at 6.

²²¹ WISPA Comments at 6.

²²² Comsearch Reply Comments at 9 (quoting Scientel Comments at 14–15).

²²³ *Id.* (“Comsearch observes that the following modifications should not increase the interference potential: EIRP and/or emission bandwidth reductions, provided that the power density is the same or reduced, and antenna upgrades that have the same or better radiation suppression specifications at all angles.”).

²²⁴ See WISPA Reply Comments at 6.

to parameters that typically would not be considered major in other contexts,²²⁵ like increases to receive antenna height, could make an existing link more susceptible to interference. Given the sensitivity of the first-in-time rights to changes in the interference environment, we believe that it is prudent to define de minimis modifications in this context very narrowly. Based on our analysis of the comments in the record we will define de minimis modifications as those that meet all of the following criteria:

- The modification is necessary to repair or replace registered, constructed, and operating equipment;
- The modification does not increase the EIRP of a digital system or change the EIRP of an analog system;²²⁶
- The modification does not increase the channel bandwidth;
- The modification does not change the power density;
- The modification does not increase the receiver sensitivity;
- The modification does not increase the antenna beamwidth;
- The modification does not increase the antenna gain, except where there is a corresponding reduction transmitter power so that there is no increase in EIRP;
- The modification does not involve a change to antenna with less off-axis attenuation at any angle; and
- The modification does not change any other technical parameters not mentioned above.

79. Under the definition adopted above, any modification to a registration that could make a link more susceptible to interference or more likely to cause interference will result in a new date for first-in-time coordination purposes.²²⁷ We find that the limited definition of a de minimis modification adopted in this *Report and Order* will minimize the risk of harmful interference and promote efficient access to these bands.

D. Other Issues

80. We do not take action at this time on several other issues raised in the Commission's inquiries in this proceeding, or by commenters in the record owing to absence of notice, an inadequate record, or lack of consensus on a path forward. To wit, in the *70/80/90 GHz NPRM* we sought comment on a proposal relating to authorizing mobile operations on a non-interference basis to fixed operations along the United States' international borders with Canada and Mexico, subject to future international agreements.²²⁸ This specific issue was not addressed by any filers. In the absence of a developed record on this issue, we do not address it at this time.

81. Separately, in the *HAPS Public Notice* WTB sought to supplement the record on the possibility of bringing HAPS and/or other stratospheric-based platform services into the 70/80/90 GHz bands.²²⁹ The record, including analysis provided by the Federal Agencies, contains highly divergent

²²⁵ See 47 CFR § 1.929.

²²⁶ For analog systems the interference criteria in rule section 101.105 is specified as a C/I ratio, so decreases in EIRP could change the C/I ratio and potentially make a link more susceptible to interference. Therefore, for analog systems any modification that changes the EIRP will not be considered de minimis, and a new date will be applied for first-in-time purposes.

²²⁷ See SIA Comments at 3.

²²⁸ *70/80/90 GHz NPRM*, 35 FCC Rcd at 6059, para. 52.

²²⁹ *HAPS Public Notice*, 36 FCC Rcd at 14375.

claims regarding the possibility of integrating HAPS operations into the 70/80/90 GHz bands,²³⁰ with limited actual data to support such action.²³¹ We therefore decline at this time to adopt rules for HAPS operations in the 70/80/90 GHz bands. We do note that any party—including HAPS providers—can engage in operations consistent with the rules of general applicability for aeronautical services adopted in this *Report and Order*.

82. Beginning in *ex parte* presentations, and later in other filings in this docket, SpaceX requested that we amend our rules to allow the registration of FSS earth stations in the third-party link registration database for the 70 GHz and 80 GHz bands.²³² While FSS has a co-primary shared allocation, the Commission has not yet developed service rules for FSS operations in these bands.²³³ As FSS operations differ in significant ways from the FS operations that the third-party database system was originally designed to accommodate, adding FSS to this system would likely require development of different coordination parameters, and possibly additional interference mitigation techniques to protect federal operations in the bands.²³⁴ Moreover, SpaceX notes that the interference mitigations proposed in the Federal Agencies Letter, which inform the rules to accommodate airborne and maritime point-to-endpoints-in-motion in the third-party database system that we adopt today, would not be appropriate for FSS operations in the 70 GHz and 80 GHz bands.²³⁵ Without the development of a record on the specifics required to include FSS earth stations in the third-party database, or federal inter-agency discourse on this

²³⁰ Compare, e.g., NASA et al. HAPS Public Notice Comments at 5 (“The record is unclear as to the specific requirement for additional spectrum access into the 70/80/90 GHz bands to support HAPS, and whether existing allocations are either congested or unsuitable. . . . The PN does note that ‘several advocates for HAPS are no longer pursuing their planned operations’ in certain bands and are seeking access into 70/80 GHz. . . . Any additional usages for active services should be based on sound engineering studies to determine the limitations on unwanted emission levels to protect EESS (passive), EESS (active) and SRS (passive) operations prior to allowing HAPS systems to operate” in these bands.) with HAPS Alliance HAPS Public Notice Comments at 1–2. See also, e.g., T-Mobile HAPS Public Notice Comments at 3 (“There is no reason for the Commission to modify its rules to accommodate HAPS or similar services in the 70/80/90 GHz bands. There is little current documented interest in those services and, unlike 5G, no deployment.”).

²³¹ The only advocate for HAPS inclusion in 70/80/90 GHz to provide a detailed technical study in the record, Loon LLC, shuttered in early 2021. See Astro Teller, *Loon’s Final Flight*, Medium (Jan. 21, 2021), <https://blog.x.company/loons-final-flight-e9d699123a96> (official company blog); see also Letter from Julie M. Kearney, Global Head of Communications Regulation and Policy, Loon, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed Jan. 14, 2021) (attaching a study by Comsearch entitled “Loon E-Band Backhaul: Analysis of Compatibility with Incumbent Fixed Services, Use of the Link Registration System, and Review Versus Passive Services.”).

²³² See, e.g., SpaceX Nov. 8, 2021 *Ex Parte* at 1–4; Letter from Jameson Dempsey, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1–2 (filed Jan. 31, 2022) (SpaceX Jan. 31, 2022 *Ex Parte*); see also, e.g., SpaceX HAPS Public Notice Comments; SpaceX HAPS Public Notice Reply Comments; SpaceX Refresh Public Notice Comments at 1–5.

²³³ As SpaceX has previously itself noted, for “the E-band . . . the Commission has not yet adopted service rules or licensed other satellite operators.” See *Space Exploration Holdings, LLC*, Application for Orbital Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System, IBFS File No. SAT-LOA-20200526-00055, Attach. Narrative App. at 6 (filed May 26, 2020) (SpaceX Gen2 Application).

²³⁴ We note that the Commission’s rules for authorization of proposed non-federal fixed terrestrial links in the 71.0–76.0 GHz and 81.0–86.0 GHz bands do not address co-band, non-Federal FSS Earth stations and thus non-federal terrestrial licensees are not required to analyze the potential for harmful interference to or from a proposed link to non-federal gateway Earth stations previously authorized or pending in ICFS under the default service rules.

²³⁵ SpaceX Refresh Public Notice Comments at 5 (“While NTIA’s specific technical proposals may be appropriate to assess interference from Aeronet’s 70/80 GHz links into other federal and non-federal users—and SpaceX does not comment on the appropriateness of those values for Aeronet—they are not well-tailored to fixed-satellite service operations in the 70/80 GHz band.”).

prospect, we are not in a position today to take this step. However, we seek further input on these issues in the *Further Notice* portion of this item immediately below.

83. The fact that we are not adding FSS to the third-party database registration system does not impair the ability of FSS operators to continue to deploy and operate new earth stations in the 70/80/90 GHz bands,²³⁶ subject to prior coordination with existing incumbents.²³⁷

84. In response to certain concerns raised in the record,²³⁸ we emphasize that the allocations in the 70/80/90 GHz bands have not changed. FSS and FS remain co-primary, and the Commission continues to have policies in place that allow for coexistence. First-in-time priority rights serve as the foundation for such coexistence in the 70/80/90 GHz bands, as they do in other spectrum bands shared by FS and FSS; nothing we adopt today disturbs this status quo.²³⁹

IV. FURTHER NOTICE OF PROPOSED RULEMAKING

85. In this *Further Notice*, we seek comment on two issues for which the record in this proceeding is not sufficient for us to make a determination at this time: (1) whether to permit ship-to-aerostat transmissions as part of the maritime service otherwise authorized in the *Report and Order*; and (2) whether to include FSS earth stations in the existing third-party database registration regime modified in the *Report and Order*.²⁴⁰

86. *Inclusion of Ship-to-Aerostat Transmissions in the Maritime Service.* In the *Report and Order*, we declined to permit ship-to-aerostat transmissions at this time. We note that Aeronet has expressed concern that ship-to-aerostat links are critical to the operation of its maritime system and that the maritime broadband services otherwise authorized in the *Report and Order* depend on the availability of a return link.²⁴¹ We seek comment on whether to authorize such transmissions, including input on the potential impact on federal and other non-federal operations.

87. *Inclusion of FSS in Third-Party Database Registration System.* In the *Report and Order*, we declined to include FSS earth stations in the third-party database registration system because of lack of notice, and a record insufficient to address this issue. SpaceX has advocated for the inclusion of FSS into

²³⁶ We note, for example, that SpaceX has filed earth and space station applications to authorize its operations in the 70/80/90 GHz bands pursuant to the part 25 default service rules, and is currently operating under special temporary authorizations (STAs) pending completion of federal coordination on its applications for final authorization.

²³⁷ Satellite operations were not yet permitted in the E-band in 2003 when the Commission adopted the license/registration approach for non-federal terrestrial links. *Allocations and Service Rules for the 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318, 23344, paras. 61–62 (2003). The Commission recognized, however, that there were co-primary satellite allocations in various portions of the E-band and decided to maintain multiple services in the allocation table and address possible sharing criteria in the future stating that “all terrestrial 71–76 GHz and 81–86 GHz band entities are hereby made aware that future operations of satellite and satellite earth stations could be permitted in the 71–76 GHz and 81–86 GHz bands. Once the Commission considers and adopts technical standards for terrestrial and satellite operations to share this spectrum, all licensees will be expected to satisfy these and any other Part 101 requirements.” *Id.*, 18 FCC Rcd at 23344, para. 63. See also *id.* para. 61 (Commission noted that “[it] must take further action under Part 25 of our Rules for earth stations to operate in the 71–76 GHz (downlink) and 81–86 GHz (uplink) bands”).

²³⁸ See Almagest Space Corp. Refresh Public Notice Comments at 2–3; Sierra Nevada Corp. Refresh Public Notice Comments at 1–2.

²³⁹ Cf. e.g., FWCC Refresh Public Notice Comments at 4–5 (seeking preferential treatment for FS); AT&T Refresh Public Notice Comments at 3–4 (same); CTIA Refresh Public Notice Comments at 3–6 (same).

²⁴⁰ See Sections III.A.2.c and III.D, *supra*.

²⁴¹ See Aeronet Jan. 19, 2024 *Ex Parte* at 1–2; see also Aeronet Jan. 10, 2024 *Ex Parte* at 2.

the existing light-licensing regime for the 70/80/90 GHz bands.²⁴² To date, few parties have addressed the feasibility of these proposals, and those that have mentioned the issue have suggested that operational limitations and/or further technical study would be needed.²⁴³ As SpaceX contends and others support,²⁴⁴ incorporating earth station gateways in the third-party database would enable the light-licensing approach currently used for operations under subpart Q of part 101 to serve as a unified portal for operations in the 70 GHz and 80 GHz bands that are licensed under a nationwide, non-exclusive license. We recognize that a unified database may provide efficiencies for the use of these bands and may offer other benefits.

88. Accordingly, we seek comment on the potential inclusion of FSS earth stations in the third-party database registration regime in the 70 GHz and 80 GHz bands. As a general matter, would it be feasible to include FSS in the database registration process? Would doing so have any negative effects on incumbent services? What changes would be necessary to the database system to accommodate FSS registrations, and would those changes be feasible? We note that in response to the aeronautical and maritime rules we adopt today, at least one party has articulated how “major modifications to the databases or most likely entirely new structures” may be necessary, and that “[m]aking [these] changes . . . and developing enhanced analysis methods to cover coordination zones . . . would have to be supported by the proponents” of the newly included operations in the bands.²⁴⁵ We seek comment on whether analogous concerns exist for the changes that may be necessary to permit FSS into the regime, and on the allocation of costs for such changes.

²⁴² See SpaceX Oct. 12, 2021 *Ex Parte*; SpaceX Nov. 8, 2021 *Ex Parte* at 2; SpaceX HAPS Public Notice Comments at 6–8; SpaceX HAPS Public Notice Reply Comments at 1–4; Letter from David Goldman, Director, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1 (filed Jan. 6, 2022); SpaceX Jan. 31, 2022 *Ex Parte* at 1; SpaceX May 23, 2022 *Ex Parte* at 1–2; Letter from Jameson Dempsey, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1–2 (filed May 31, 2022); SpaceX July 25, 2022 *Ex Parte* at 1–2; Letter from Jameson Dempsey, Principal, Satellite Policy, Space Exploration Technologies Corp., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 1 (filed Aug. 22, 2022).

²⁴³ For example, Comsearch, one of the two third-party database providers, does not reference FSS in its comments responding to the *Refresh Public Notice* or in most of its other entries in the docket. *Cf., e.g.,* Comsearch Refresh Public Notice Comments; Letter from Joseph N. Marzin, Director, Technology Group, Comsearch, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed June 2, 2022); Letter from Peter S. Young, Principal Engineer, Comsearch, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed Aug. 20, 2021); Comsearch Reply Comments; Commscope and Comsearch Comments. *But see* Comsearch HAPS Public Notice Comments at 1–2 (discussing in one paragraph the inclusion of FSS earth stations in the current ecosystem). Further, at least one other satellite-specific interest objected to SpaceX’s proposals. Letter from Jennifer Manner, Senior Vice President, Regulatory Affairs, Hughes Network Systems, LLC, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133, at 2–3 (filed June 29, 2022) (“The Commission also should reject SpaceX’s proposed new technical limits for FSS earth stations in the 80 GHz band. Such technical limits are outside the scope of this proceeding, which is limited to proposed changes to the Part 101 rules applicable to terrestrial services only. . . . SpaceX’s proposal unfairly favors NGSO over GSO FSS earth stations, and provides no basis to extend technical limits on terrestrial operations to FSS earth stations not otherwise subject to those limits. . . . [T]he Commission should reject . . . SpaceX’s proposed application of a unified light-licensing framework, including technical limits otherwise applicable to terrestrial services only, to satellite operations in the bands.”).

²⁴⁴ See, e.g., Dynamic Spectrum Alliance Comments at 4 (“we see no technical reason why the 70/80 GHz database could not serve as a comprehensive repository of all non-federal links, whether they are traditional fixed point-to-point links; links to, from, and between antennas in motion on ships or aircraft; or gateway links in a nongeostationary satellite network”); SIA Comments at 4 (“the registration system should, on a going-forward basis, account for both terrestrial and satellite users”); Geneva Communications LLC Comments at 2; New America’s Open Technology Institute and Public Knowledge Comments at 4; *see generally* Letter from Jameson Dempsey, Director, Satellite Policy, SpaceX, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 20-133 (filed Jan. 17, 2024).

²⁴⁵ Comsearch Refresh Public Notice Comments at 1.

89. If we do incorporate FSS earth stations into the third-party database system, under what protection criteria should they be included? SpaceX argues that the limits set forth in the Federal Agencies Letter, which we today adopt for aeronautical operations in these bands, are inappropriate for FSS, and urges us to instead adopt the rules found in part 25 as a guide to the appropriate operational restrictions for FSS in this context.²⁴⁶ The part 25 rules, however, contemplate individual coordination of earth stations, and therefore may not be a good fit for LRS, the third-party database system that is used to coordinate operations in these bands.²⁴⁷ The EIRP limit for earth stations in part 25 is much more generous than the EIRP limits for fixed and aeronautical services in these bands.²⁴⁸ For earth stations that are individually coordinated, this higher-powered limit may be modified to suit the specific circumstances and satisfy all potentially affected parties. For database coordination, however, the EIRP limit must be such that coexistence with other operators and services is possible without such individual attention. The EIRP limits we adopt today for aeronautical service are the product of significant attention, analysis and input from a variety of parties and perspectives, including those operators and services most likely to be affected by any harmful interference.²⁴⁹ We seek similar comment on appropriate EIRP limits for FSS earth stations in the 70 GHz and 80 GHz bands. What limits would best enable meaningful FSS service, while adequately protecting incumbent operations? In a similar vein, we seek comment on the appropriate OOB limits for FSS earth stations in these bands, given the importance of protecting adjacent band operations. We also seek comment generally on any other operational limits or restrictions that might be required to meaningfully enable database registration for FSS earth stations without risking harmful interference to incumbent and adjacent services.

90. We seek comment on the appropriate criteria for the protection of FSS from other services. The rules that we adopt today are designed in part to protect FSS operations, both Federal and non-Federal, from the newly established aeronautical service. However, there are currently no rules requiring fixed links to protect FSS operations. What criteria could be implemented for this purpose? Current part 101 rules include an interference protection threshold for fixed services.²⁵⁰ Is there a similar appropriate threshold for satellite earth stations? Are there any other protection criteria that might be necessary to ensure that other services in these bands do not cause harmful interference to FSS operations? Consistent with the Commission's statement when it adopted service rules for FS use of the band,²⁵¹ we propose to require registrations for new FS links submitted on or after the release date of this *Further Notice* to demonstrate protection of FSS earth stations with a final authorization prior to the submission date of the new FS registration.

91. Finally, we seek comment on any changes that would be necessary to our rules or procedures to accommodate FSS in the third-party database system as a logistical matter. Currently, terrestrial and aeronautical operators must first obtain a nationwide license from the Commission before registering individual sites with a database administrator.²⁵² What would be the equivalent for a satellite

²⁴⁶ See, e.g., SpaceX Refresh Public Notice Comments at 5.

²⁴⁷ See, e.g., 47 CFR § 25.251 ("Special requirements for coordination").

²⁴⁸ 47 CFR § 25.204(b) (+ 64 dBW in any 1 megahertz band); *id.* § 101.113 (+55 dBW). Because the part 25 limit is expressed as a power density, while the part 101 limit is not, this is not a direct comparison. Converting the part 25 limit to 70/80 GHz channel sizes, which are at minimum 1.25 gigahertz, yields an equivalent EIRP of, at minimum, +94.96 dBW toward the horizon, or 39.96 dB higher than the part 101 limit, while for a 4.5 gigahertz channel the part 25 limit would allow an EIRP 45.53 dB higher than the part 101 limit.

²⁴⁹ See, e.g., Federal Agencies Letter at 1–2 (detailing in part incumbent federal operations in and adjacent to the 70 GHz and 80 GHz bands); *id.*, Attach. B at 1–11; Comsearch Report at 24–32.

²⁵⁰ 47 CFR § 101.105(a).

²⁵¹ See *supra* note 237.

²⁵² See *supra* para. 18; see also *infra* App. A; 47 CFR § 101.1501.

operator? Should a satellite operator also be required to obtain a nationwide license from the Commission before registering individual sites with a database administrator? If so, what changes would be required to the part 25 earth station licensing rules? We also seek comment on any changes necessary for federal to non-federal coordination in the FSS context. For fixed services in these bands, this coordination is accomplished by the database administrators querying an automated green light/yellow light system operated by NTIA, with a yellow light result leading to more individual coordination.²⁵³ Could this system accommodate FSS operations as well? What changes would be necessary to support such inclusion? We seek comment generally on these and any other issues raised by the possibility of including FSS earth stations in the 70/80 GHz database registration system.

V. PROCEDURAL MATTERS

92. *Regulatory Flexibility Act.* The Regulatory Flexibility Act of 1980, as amended (RFA),²⁵⁴ requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.”²⁵⁵ Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of the rule changes contained in this *Order* on small entities. The FRFA is set forth in Appendix B.

93. The Commission has also prepared an Initial Regulatory Flexibility Analysis (IRFA) concerning the potential impact of rule and policy changes in the *Further Notice* on small entities. The IRFA is set forth in Appendix C. Written public comments are requested on the IRFA. Comments must be filed by the deadlines for comments on the *Further Notice* indicated on the first page of this document and must have a separate and distinct heading designating them as responses to the IRFA.

94. *Paperwork Reduction Act.* This document contains new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13.²⁵⁶ It will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. OMB, the general public, and other federal agencies will be invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. We have described impacts that might affect small businesses, which include most businesses with fewer than 25 employees, in the FRFA, attached as Appendix B.

95. The *Further Notice* also may contain proposed new and revised information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and OMB to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. § 3506(c)(4), we seek specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

²⁵³ 47 CFR § 101.1523; *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23342–43, para. 54; *Wireless Telecommunications Bureau Announces Licensing and Interim Link Registration Process, Including Start Date for Filing Applications for Non-Exclusive Nationwide Licenses in the 71–76 GHz, 81–86 GHz, and 92–95 GHz Bands*, WT Docket No. 02-146, Public Notice, 19 FCC Rcd 9439, 9447 (WTB 2003).

²⁵⁴ 5 U.S.C. §§ 601–612. The RFA has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

²⁵⁵ 5 U.S.C. § 605(b).

²⁵⁶ 44 U.S.C. §§ 3501–20.

96. *Congressional Review Act.* The Commission will submit this draft *Report and Order* to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, for concurrence as to whether this rule is “major” or “non-major” under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this *Report and Order* to Congress and the Government Accountability Office pursuant to 5 U.S.C. § 801(a)(1)(A).

97. *Providing Accountability Through Transparency Act:* The Providing Accountability Through Transparency Act requires each agency, in providing notice of a rulemaking, to post online a brief plain-language summary of the proposed rule.²⁵⁷ Accordingly, the Commission will publish the required summary of this *Further Notice* on <https://www.fcc.gov/proposed-rulemakings>.

98. *Ex Parte Presentations—Permit-But-Disclose.* The proceeding this *Further Notice* initiates shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.²⁵⁸ Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made; and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter’s written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with section 1.1206(b) of the Commission’s rules. In proceedings governed by section 1.49(f) of the Commission’s rules or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission’s *ex parte* rules.²⁵⁹

99. *Comment Filing Procedures.* Pursuant to sections 1.415 and 1.419 of the Commission’s rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission’s Electronic Comment Filing System (ECFS). See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing ECFS: <https://www.fcc.gov/ecfs>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing.
- Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission’s Secretary, Office of the Secretary, Federal Communications Commission.

²⁵⁷ 5 U.S.C. § 553(b)(4). The Providing Accountability Through Transparency Act, Pub. L. No. 118-9 (2023), amended section 553(b) of the Administrative Procedure Act.

²⁵⁸ 47 CFR §§ 1.1200 *et seq.*

²⁵⁹ *Id.* § 1.49(f).

- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701. U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street NE, Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. *See* FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy, Public Notice, DA 20-304 (March 19, 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.

100. *People with Disabilities.* To request materials in accessible formats for people with disabilities (Braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice).

101. *Further Information.* For additional information on this proceeding, contact Jeffrey Tignor of the Wireless Telecommunications Bureau, Broadband Division, at Jeffrey.Tignor@fcc.gov or 202-418-0774.

VI. ORDERING CLAUSES

102. **IT IS ORDERED** that, pursuant to sections 4(i), 301, 302, 303(c), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 301, 302a, 303(c), 303(f), and 303(r), that this *Report and Order* **IS ADOPTED** as set forth above.

103. **IT IS FURTHER ORDERED** that, pursuant to sections 4, 303, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154, 303, 307, that this *Further Notice of Proposed Rulemaking* **IS ADOPTED** as set forth above.

104. **IT IS FURTHER ORDERED** that the amendments of the Commission's rules as set forth in Appendix A ARE ADOPTED, effective thirty days from the date of publication in the Federal Register, except for: (1) section 101.147(z)(3), which will take effect on September 1, 2024; and (2) sections 101.63(b), 101.1523(a), (e), and 101.1528 (a)(11), (b)(10), and (d), which contain new or modified information collection requirements that requires approval by the Office of Management and Budget under the Paperwork Reduction Act and will take effect after the Commission publishes a notice in the Federal Register announcing such approval and the relevant effective date(s).

105. **IT IS FURTHER ORDERED** that the Commission's Office of the Secretary, **SHALL SEND** a copy of this *Report and Order and Further Notice of Proposed Rulemaking*, including the Final Regulatory Flexibility Analysis and Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

106. **IT IS FURTHER ORDERED** that the Office of the Managing Director, Performance and Program Management, **SHALL SEND** a copy of this *Report and Order* in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A**Final Rules**

For the reasons discussed in the document above, the Federal Communications Commission amends 47 CFR parts 0 and 101 as follows:

PART 0 – COMMISSION ORGANIZATION

1. The authority citation for part 0 continues to read as follows:

Authority: 47 U.S.C. 151, 154(i), 154(j), 155, 225, and 409, unless otherwise noted.

2. Section 0.241 is amended by adding paragraph (l) to read as follows:

§ 0.241 Authority delegated.

* * * * *

(l) The Chief of the Office of Engineering and Technology is delegated authority, jointly with the Chief of the Wireless Telecommunications Bureau, to establish and administer a process for review of proposed technologies for point-to-endpoint-in-motion communications to aircraft and ships in the 71–86 GHz and 81–86 GHz bands to ensure compliance with the requirements adopted by the Commission.

3. Section 0.331 is amended by adding paragraph (g) to read as follows:

§ 0.331 Authority delegated.

* * * * *

(g) The Chief of the Wireless Telecommunications Bureau is delegated authority, jointly with the Chief of the Office of Engineering and Technology, to establish and administer a process for review of proposed technologies for point-to-endpoint-in-motion communications to aircraft and ships in the 71–86 GHz and 81–86 GHz bands to ensure compliance with the requirements adopted by the Commission. The Chief of the Wireless Telecommunications Bureau is also delegated authority to establish and administer specific procedures to be followed for coordinating and registering aeronautical and maritime stations and their associated transmissions.

PART 101 – FIXED MICROWAVE SERVICES

4. The authority citation for part 101 continues to read as follows:

Authority: 47 U.S.C. 154, 303.

5. Section 101.63 is amended by revising paragraph (b) to read as follows:

§ 101.63 Period of construction; certification of completion of construction.

* * * * *

(b) For the 70 GHz, 80 GHz, and 90 GHz bands, the 12-month construction period will commence on the date of each registration of each individual link; adding links will not change the overall renewal period of the license. For each individual link, a licensee who commences operations within the construction period must certify in the third-party link registration database, such as those

established pursuant to section 101.1523, that the link is constructed and operational. The certification must be filed within 15 days of the expiration of the applicable construction period for each individual link. If operations have begun using some, but not all, of the authorized transmitters, the certification must show to which specific transmitters it applies. After 15 days of the end of the construction period for each individual link, if the licensee has not certified that the link is constructed and operational, the third-party database managers will delete the registration from the database.

* * * * *

6. Section 101.111 is amended by adding paragraph (a)(2)(vi) to read as follows:

§ 101.111 Emission limitations.

(a) * * *

(2) * * *

(vi) In order to protect Federal Earth Exploration-Satellite Service (passive), aeronautical and maritime endpoints in motion operating in the 70 and 80 GHz bands must comply with the following limits:

- Ground-to-air transmissions shall not exceed an unwanted emission level of -38.5 dBW per 100 MHz in any portion of the 86–92 GHz passive band;
- Air-to-air, ship-to-shore, and aerostat-to-shore transmissions shall not exceed an unwanted emission level of -29.7 dBW per 100 MHz in any portion of the 86–92 GHz passive band.

Any changes to system specifications, operations, or deployment scenarios for aeronautical or maritime end points in motion shall be pre-coordinated with NTIA and affected federal agencies, and licensees of aeronautical or maritime end points in motion must cooperate fully with any updates to the required unwanted emission limits that may result from these modifications.

* * * * *

7. Section 101.113 is amended by adding footnote 14 to the entries of “71,000 to 76,000” and “81,000 to 86,000” in the table of paragraph (a) to read as follows:

§ 101.113 Transmitter power limitations.

(a) * * *

\14\ The EIRP limit for fixed and mobile stations used for aeronautical and maritime endpoints in motion is 57 dBW.

* * * * *

8. Section 101.115 is amended by removing the entries of “71,000 to 76,000” and “81,000 to 86,000” in the table of paragraph (b)(2), and by adding four new entries in numerical order, and by revising footnote 14 to read as follows:

§ 101.115 Directional antennas.

* * * * *

(b) * * *

(2) * * *

ANTENNA STANDARDS

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points ¹ (included angle in degrees)	Minimum antenna gain (dBi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
* * * * *										
71,000 to 76,000 (co-polar) ¹⁴	N/A	2.2	38	22	28	32	35	37	55	55
71,000 to 76,000 (cross-polar) ¹⁴	N/A	2.2	38	35	35	40	42	47	55	55
81,000 to 86,000 (co-polar) ¹⁴	N/A	2.2	38	22	28	32	35	37	55	55
81,000 to 86,000 (cross- polar) ¹⁴	N/A	2.2	38	35	35	40	42	47	55	55
* * * * *										

* * * * *

\14\ Antenna gain less than 50 dBi (but greater than or equal to 38 dBi) is permitted only with a proportional reduction in maximum authorized EIRP in a ratio of 2 dB of power per 1 dB of gain, so that the maximum allowable EIRP (in dBW) for antennas of less than 50 dBi gain becomes + 55-2(50-G), where G is the antenna gain in dBi. In addition, antennas in these bands must meet the following additional standard for minimum radiation suppression: At angles of less than 5 degrees from the centerline of main beam, cross-polar discrimination must be at least 21 dB.

* * * * *

9. Effective September 1, 2024, section 101.147 is amended by adding paragraph (z)(3) to read as follows:

§ 101.147 Frequency assignments.

* * * * *

(z) * * *

(3) The following channel plans apply to the 71,000–76,000 MHz and 81,000–86,000 MHz bands:

(i) 250 MHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71250	81250
71500	81500
71750	81750
72000	82000
72250	82250
72500	82500
72750	82750
73000	83000
73250	83250
73500	83500
73750	83750
74000	84000
74250	84250
74500	84500
74750	84750
75000	85000
75250	85250
75500	85500
75750	85750

(ii) 500 MHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71375	81375
71875	81875
72375	82375
72875	82875
73375	83375
73875	83875
74375	84375
74875	84875
75375	85375

(iii) 750 MHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71500	81500
72250	82250
73000	83000
73750	83750
74500	84500
75250	85250

(iv) 1 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71625	81625
72625	82625
74125	84125
75125	85125

(v) 1.25 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71750	81750
73000	83000
74250	84250

(vi) 1.5 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
71875	81875
74375	84375

(vii) 1.75 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72000	82000
74500	84500

(viii) 2.0 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72125	82125
74625	84625

(ix) 2.25 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72250	82250
74750	84750

(x) 2.5 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72375	82375

(xi) 2.75 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72500	82500

(xii) 3 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72625	82625

(xiii) 3.25 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72750	82750

(xiv) 3.5 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
72875	82875

(xv) 3.75 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
73000	83000

(xvi) 4 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
73125	83125

(xvii) 4.25 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
73250	83250

(xviii) 4.5 GHz authorized bandwidth.

Transmit (receive) (MHz)	Receive (transmit) (MHz)
73375	83375

10. Section 101.1501 is revised to read as follows:

§ 101.1501 Service areas.

The 70/80/90 GHz bands are licensed on the basis of non-exclusive nationwide licenses. There is no limit to the number of non-exclusive nationwide licenses that may be granted for these bands, and these licenses will serve as a prerequisite for registering individual point-to-point links. In the 71–76 GHz and 81–86 GHz bands, nationwide non-exclusive licenses also serve as a blanket license for air-to-air and ship-to-ship operations, and as a prerequisite to register ground-to-air (GTA) stations and to operate associated GTA and air-to-ground (ATG) transmissions; and as a prerequisite to register shore stations and aerostat relay stations and to operate associated ship-to-shore, shore-to-ship, shore-to-aerostat, aerostat-to-ship, and aerostat-to-shore transmissions.

11. Section 101.1507 is revised to read as follows:

§ 101.1507 Permissible operations.

Licensees may use the 70 GHz, 80 GHz, and 90 GHz bands for any point-to-point, non-broadcast service. Licensees may use the 70 GHz and 80 GHz bands for aeronautical and maritime service as set forth in section 101.1528. The segments may be unpaired or paired, but pairing will be permitted only in a standardized manner (*e.g.*, 71–72.25 GHz may be paired only with 81–82.25 GHz, and so on). The segments may be aggregated without limit.

12. Section 101.1523 is amended by revising paragraphs (a) and (b)(1), and adding paragraph (e) to read as follows:

§ 101.1523 Sharing and coordination among non-government licensees and between non-government and government services.

(a) Each individual point-to-point link must be registered in a third-party database. Registration of aeronautical ground stations, maritime shore stations, and aerostats for operation of aeronautical or maritime links to end points in motion in the 71–76 GHz and 81–86 GHz bands will be in a third party database after the Wireless Telecommunications Bureau announces by public notice the details of the implementation of a third-party database for such links to endpoints in motion.

* * * * *

(e) A licensee must successfully complete the requirements of this section prior to modifying the technical parameters of a registered link. Except for de minimis modifications, any change to the technical data on a link registration will result in a new interference protection date. A modification to link registration in the 71–76 GHz and 81–86 GHz bands is de minimis, and the registration will retain its existing interference protection date and not lose its existing first-in-time rights, if the modification meets all of the following criteria:

- The licensee certifies that the modification is necessary to repair or replace equipment specified in the registration that was constructed and operating under the registration, and;

- The modification does not increase the EIRP of a digital system or change the EIRP of an analog system;
- The modification does not increase the channel bandwidth;
- The modification does not change the power density;
- The modification does not increase the receiver sensitivity;
- The modification does not increase the antenna beamwidth;
- The modification does not increase the antenna gain, except where there is a corresponding reduction transmitter power so that there is no increase in EIRP;
- The modification does not involve a change to antenna with less off-axis attenuation at any angle; and
- The modification does not change any other technical parameters not mentioned above.

13. Section 101.1528 is added to subpart Q to read as follows:

§ 101.1528 Requirements for Aeronautical and Maritime Links to, from, or between Endpoints in Motion.

(a) Requirements for Aeronautical Ground Stations and Endpoints in Motion

(1) Air-to-Ground transmissions are permitted only in the 71–76 GHz band.

(2) Ground-to-Air transmissions are permitted only in the 81–86 GHz band.

(3) Air-to-Air transmissions are permitted only between aircraft that are separated by a minimum slant path distance of 50 km.

(4) Transmissions are only permitted to and from aircraft at altitudes between 10,000 ft and 50,000 ft.

(5) Ground stations must operate with a minimum elevation angle of 5 degrees and a maximum elevation angle of 45 degrees.

(6) Ground stations must be located at least 10 km from any existing Non-Federal FSS earth station or federal facility listed in paragraph (c)(2) – Table 2 of this section, absent a coordination agreement with the FSS operator.

(7) Ground stations must be located at least 150 km from the specific federal facilities and not within the areas listed in paragraph (c)(1) – Table 1 of this section, absent a coordination agreement with the federal operator.

(8) Ground stations must be located at least 10 km from any existing federal or non-federal fixed station receiver, absent a coordination agreement with the fixed station operator.

(9) Air-to-air transmissions are permitted in 81–86 GHz subject to the following limitations;

(i) EIRP signal levels radiated along a line between the airborne transmitter and the latitude and longitude of the observatories in paragraph (c)(1) – Table 1 of this section, which must be maintained as the airborne transmitter moves, cannot exceed the levels shown in Table A, below. Within the range of 150 km and 375 km, the maximum allowable EIRP levels for horizontal distances not listed in table below may be approximated by linear interpolation.

Table A - List of Maximum Allowable EIRP levels, in dBW

Frequency (GHz)	Horizontal Distance (km)									
	150	175	200	225	250	275	300	325	350	375
81	-11.2	-8.8	-6.5	-4.2	-1.5	1.1	3.9	6.7	10	13.5
82	-11.5	-9.2	-6.9	-4.6	-2	0.5	3.2	6	9.2	12.6
83	-11.7	-9.5	-7.3	-5	-2.4	0	2.7	5.4	8.6	11.9
84	-11.9	-9.7	-7.5	-5.3	-2.8	-0.4	2.3	4.9	8	11.3
85	-12.1	-9.9	-7.8	-5.5	-3	-0.7	1.9	4.5	7.6	10.8
86	-12.2	-10	-7.9	-5.7	-3.3	-0.9	1.7	4.2	7.3	10.5

(ii) A licensee of aeronautical end points in motion must have a capability to target specific areas which can be added to a “block list” as part of a dynamic link management system. If air-to-air transmission within the main beam of the radio astronomy receiver cannot be avoided, air-to-air transmissions within the radio horizon of the radio astronomy site (as specified in Table B below) should not occur.

Table B - Approximate Radio Horizon, in Horizontal Distance (km)

Altitude (m)	Approximate Radio Horizon (km) (horizontal distance)
10,360	375
8,000	315
6,000	260
5,000	220
4,000	180
3,000	125

(iii) The list of radio astronomy sites may be periodically updated by the NTIA and the FCC. This rule may be superseded by a coordination agreement between the licensee and NSF, in which case the coordination agreement will specify the technical restrictions.

(10) Air-to-air transmissions in the 71–76 GHz band are subject to the following restrictions:

(i) EIRP signal levels shall be limited to 20 dBW/1000 MHz towards each military installation listed in paragraph (c)(2) – Table 2 of this section that is within 375 km of the airborne transmitter. This 20 dBW/1000 MHz EIRP applies to the power radiated along a line between the airborne transmitter and the latitude and longitude of the military installations in paragraph (c)(2) – Table 2 of this section and must be maintained as the airborne transmitter moves. An EIRP of 57 dBW/1000 MHz is allowed in other directions. The list of military installations in paragraph (c)(2) – Table 2 of this section may be periodically updated by the NTIA and the FCC. This rule may be superseded by a coordination agreement between the licensee and the Department of Defense (DoD), in which case the coordination agreement will specify the technical restrictions and allow the licensee and DoD to update the list of protected installations in the agreement. The locations of all aeronautical end-point-in-motion ground stations will be provided to NTIA and DoD as part of the coordination process.

(ii) A licensee of aeronautical end points in motion must have a capability to target specific areas which can be added to a “block list” as part of a dynamic link management system. If air-to-air transmission within the main beam of the radio astronomy receivers associated with the observatories in

paragraph (c)(1) – Table 1 of this section cannot be avoided, air-to-air transmissions within the radio horizon of the radio astronomy site (as specified in Table B above) should not occur.

(iii) The list of radio astronomy sites may be periodically updated by the NTIA and the FCC. This rule may be superseded by a coordination agreement between the licensee and NSF, in which case the coordination agreement will specify the technical restrictions.

(11) Aeronautical operators must coordinate with federal operators and register ground-to-air stations, and must not operate such facilities or any associated air-to-ground transmissions until registration has successfully been completed.

(b) Requirements for Maritime Shore Stations, Aerostats, and Endpoints in Motion

(1) Ship-to-Shore Transmissions are only permitted in the 81–86 GHz band.

(2) Shore-to-Ship Transmissions are only permitted in the 71–76 GHz band.

(3) Shore-to-Aerostat Transmissions are only permitted in the 71–76 GHz band.

(4) Aerostat-to-Ship Transmissions are only permitted in the 71–76GHz band.

(5) Aerostat-to-Shore Transmissions are only permitted in the 81–86GHz band.

(6) Aerostat must not operate above an altitude limit of 1000 ft.

(7) Ship-to-ship communications are limited to ships located more than 30 km offshore, or closer only where the main beam of the transmit antenna is oriented at least 15 degrees away from any point on the shore.

(8) Ship stations and Aerostat stations must only operate when there is a minimum separation of 150 km to the specific federal facilities and not within the areas listed in paragraph (c)(1) – Table 1 of this section, absent a coordination agreement with the federal operator.

(9) Shore-to-Ship and Ship-to-Shore transmission must only occur between stations that are located at least 10 km from the federal military installations listed in paragraph (c)(2) – Table 2 of this section, absent a coordination agreement with the federal operator.

(10) Maritime operators must coordinate with federal operators and register shore and aerostat transmitters, and must not operate such facilities or any associated ship-to-shore transmissions until registration has successfully been completed.

(c) Protected Federal Sites

(1) RAS and VLBA sites

Table 1

RAS Station Name	North Latitude	West Longitude
Arizona Radio Observatory (ARO) 12-meter	31° 57' 11.9"	111° 36' 53.6"
Green Bank Observatory	38° 25' 59"	79° 50' 23"
Very Large Array (VLA), Socorro, NM	34° 04' 44"	107° 37' 06"
Owens Valley Radio Observatory (OVRO), Big Pine, CA	37° 14' 02"	118° 16' 55"
Haystack Observatory, Westford, MA	42° 37' 24"	071° 29' 18"
National Radio Astronomy Observatory, Very Long Baseline Array Stations		
Brewster, WA	48° 07' 52"	119° 41' 00"

Fort Davis, TX	30° 38' 06"	103° 56' 41"
Hancock, NH	42° 56' 01"	71° 59' 12"
Kitt Peak, AZ	31° 57' 23"	111° 36' 45"
Los Alamos, NM	35° 46' 30"	106° 14' 44"
Mauna Kea, HI	19° 48' 05"	155° 27' 20"
North Liberty, IA	41° 46' 17"	91° 34' 27"
Owens Valley, CA	37° 13' 54"	118° 16' 37"
Pie Town, NM	34° 18' 04"	108° 07' 09"
Saint Croix, VI	17° 45' 24"	64° 35' 01"
National Radio Quiet Zone	Rectangular area between latitudes 37°30'N and 39°15'N, and longitudes 78°30'W and 80°30'W.	
Next-generation Very Large Array (ngVLA)	Rectangular area between latitudes 31°22'1.9"N and 34°23'10"N, and longitudes 109°1'53.4"W and 103°4'39"W	

(2) Military Installations

Table 2

Military Installation	Latitude	Longitude
Redstone Arsenal, AL.....	34° 41' 42" N	086° 39' 04" W
Fort Huachuca, AZ.....	31° 33' 18" N	110° 20' 59" W
Yuma Proving Ground, AZ.....	33° 01' 02" N	114° 15' 05" W
Beale AFB, CA.....	39° 06' 41" N	121° 21' 36" W
Camp Parks Reserve Forces Training Area, CA.....	34° 43' 00" N	121° 54' 08" W
China Lake Naval Air Weapons Station, CA.....	35° 41' 05" N	117° 41' 19" W
Edwards AFB, CA.....	34° 54' 58" N	117° 56' 07" W
Fort Irwin, CA.....	35° 16' 22" N	116° 41' 05" W
Marine Corps Air Ground Combat Center, CA.....	34° 13' 54" N	116° 03' 42" W
Buckley AFB, CO.....	39° 42' 36" N	104° 45' 29" W
Schriever AFB, CO.....	38° 48' 12" N	104° 31' 32" W
Fort Gordon, GA.....	33° 25' 14" N	082° 09' 09" W
Naval Satellite Operations Center, GU.....	13° 34' 55" N	144° 50' 50" E
Naval Computer and Telecomm Area Master Station, Pacific, HI...	21° 31' 16" N	157° 59' 57" W
Fort Detrick, MD.....	39° 26' 08" N	077° 25' 38" W
Nellis AFB, NV.....	36° 14' 29" N	115° 03' 03" W
Nevada Test Site, NV.....	38° 33' 41" N	116° 42' 30" W
Tonapah Test Range Airfield, NV.....	37° 47' 56" N	116° 46' 51" W
Cannon AFB, NM.....	34° 23' 23" N	103° 19' 06" W
White Sands Missile Range, NM.....	32° 56' 38" N	106° 25' 11" W
Dyess AFB, TX.....	31° 10' 10" N	099° 41' 01" W
Fort Bliss, TX.....	31° 48' 45" N	106° 25' 17" W
Fort Sam Houston, TX.....	29° 26' 34" N	098° 26' 33" W
Goodfellow AFB, TX.....	31° 26' 05" N	100° 24' 11" W
Kelly AFB, TX.....	29° 22' 51" N	098° 34' 40" W
Utah Test and Training Range, UT.....	40° 12' 00" N	112° 54' 00" W
Fort Belvoir, VA.....	38° 43' 08" N	077° 09' 15" W
Naval Satellite Operations Center, VA.....	36° 34' 00" N	076° 14' 00" W

(d) Prior to registration of any Aeronautical or Maritime links—to, from, or between endpoints in motion—each licensee must demonstrate, in accordance with the process to be established by the Wireless Telecommunications Bureau and Office of Engineering and Technology, *see* 47 CFR §§ 0.241(l), 0.331(g) of this title, that its technologies for point-to-endpoint-in-motion communications to aircraft and ships are capable of meeting specific technical and operating requirements set forth in this section.

APPENDIX B**Final Regulatory Flexibility Analysis**

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ an Initial Regulatory Flexibility Analysis (IRFA) was incorporated into the *Modernizing and Expanding Access to the 70/80/90 GHz Bands, Notice of Proposed Rulemaking (NPRM)* released in June 2020.² The Federal Communications Commission (Commission) sought written public comment on the proposals in the *NPRM*, including comments on the IRFA. No comments were filed addressing the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.³

A. Need for, and Objectives of, the Report and Order

2. In the *Report and Order*, the Commission seeks to further its goals of fostering innovation in provisioning broadband and on meeting the rapidly increasing demand for its related services by small and other entities through the adoption of new rules and modernizing current rules for the 71–76 GHz, 81–86 GHz, 92–94 GHz, and 94.1–95 GHz bands (collectively, the 70/80/90 GHz bands).

3. The adopted rules take several approaches towards achieving these goals. One approach is authorizing certain point-to-point links to endpoints in motion in the 70 GHz and 80 GHz bands under our Part 101 rules to further the use of these frequencies for access to broadband services on aircraft and ships. In the *Report and Order*, the Commission authorizes certain point-to-point links to endpoints in motion in the 71–76 GHz (the 70 GHz band) and 81–86 GHz (the 80 GHz band) bands under its part 101 rules. Another approach is updating the Commission’s rules to permit the use of smaller and lower-cost antennas to facilitate the provisioning of backhaul service in the 70 GHz and 80 GHz bands, and mandates a channelization plan in those bands. Finally, the *Report and Order* adopted changes to the link registration process in the 70/80/90 GHz bands to promote prompt construction of registered links, thereby fostering more efficient use of this spectrum and improving the accuracy of the link registration database.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

4. There were no comments filed that specifically addressed the proposed rules and policies presented in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

5. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.⁴ The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

¹ See 5 U.S.C. § 603. The RFA, 5 U.S.C. §§ 601–12, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA) Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² *Modernizing and Expanding Access to the 70/80/90 GHz Bands*, WT Docket No. 20-133, Notice of Proposed Rulemaking, 35 FCC Rcd 6039 (2020).

³ See 5 U.S.C. § 604.

⁴ 5 U.S.C. § 604(a)(3).

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

6. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the rules adopted herein.⁵ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁶ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁷ A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.⁸

7. *Small Businesses, Small Organizations, Small Governmental Jurisdictions.* Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe, at the outset, three broad groups of small entities that could be directly affected herein.⁹ First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the Small Business Administration’s (SBA) Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.¹⁰ These types of small businesses represent 99.9% of all businesses in the United States, which translates to 33.2 million businesses.¹¹

8. Next, the type of small entity described as a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹² The Internal Revenue Service (IRS) uses a revenue benchmark of \$50,000 or less to delineate its annual electronic filing requirements for small exempt organizations.¹³ Nationwide, for tax year 2020, there were approximately 447,689 small exempt organizations in the U.S. reporting revenues of \$50,000 or less according to the registration and tax data for exempt organizations available from the IRS.¹⁴

⁵ 5 U.S.C. § 604(a)(4).

⁶ 5 U.S.C. § 601(6).

⁷ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

⁸ 15 U.S.C. § 632.

⁹ See 5 U.S.C. § 601(3)–(6).

¹⁰ See SBA, Office of Advocacy, “What’s New With Small Business?,” <https://advocacy.sba.gov/wp-content/uploads/2023/03/Whats-New-Infographic-March-2023-508c.pdf> (Mar. 2023).

¹¹ *Id.*

¹² See 5 U.S.C. § 601(4).

¹³ The IRS benchmark is similar to the population of less than 50,000 benchmark in 5 U.S.C. § 601(5) that is used to define a small governmental jurisdiction. Therefore, the IRS benchmark has been used to estimate the number of small organizations in this small entity description. See Annual Electronic Filing Requirement for Small Exempt Organizations – Form 990-N (e-Postcard), “Who must file,” <https://www.irs.gov/charities-non-profits/annual-electronic-filing-requirement-for-small-exempt-organizations-form-990-n-e-postcard>. We note that the IRS data does not provide information on whether a small exempt organization is independently owned and operated or dominant in its field.

¹⁴ See Exempt Organizations Business Master File Extract (EO BMF), “CSV Files by Region,” <https://www.irs.gov/charities-non-profits/exempt-organizations-business-master-file-extract-eo-bmf>. The IRS Exempt Organization Business Master File (EO BMF) Extract provides information on all registered tax-exempt/non-profit organizations. The data utilized for purposes of this description was extracted from the IRS EO

(continued....)

9. Finally, the small entity described as a “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁵ U.S. Census Bureau data from the 2017 Census of Governments¹⁶ indicate there were 90,075 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.¹⁷ Of this number, there were 36,931 general purpose governments (county,¹⁸ municipal, and town or township¹⁹) with populations of less than 50,000 and 12,040 special purpose governments—independent school districts²⁰ with enrollment populations of less than 50,000.²¹ Accordingly, based on the 2017 U.S. Census of Governments data, we estimate that at least 48,971 entities fall into the category of “small governmental jurisdictions.”²²

10. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves.²³ Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless Internet access, and

(Continued from previous page) _____

BMF data for businesses for the tax year 2020 with revenue less than or equal to \$50,000 for Region 1-Northeast Area (58,577), Region 2-Mid-Atlantic and Great Lakes Areas (175,272), and Region 3-Gulf Coast and Pacific Coast Areas (213,840) that includes the continental U.S., Alaska, and Hawaii. This data does not include information for Puerto Rico.

¹⁵ See 5 U.S.C. § 601(5).

¹⁶ See 13 U.S.C. § 161. The Census of Governments survey is conducted every five (5) years compiling data for years ending with “2” and “7”. See also Census of Governments, <https://www.census.gov/programs-surveys/cog/about.html>.

¹⁷ See U.S. Census Bureau, 2017 Census of Governments – Organization Table 2. Local Governments by Type and State: 2017 [CG1700ORG02], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. Local governmental jurisdictions are made up of general purpose governments (county, municipal and town or township) and special purpose governments (special districts and independent school districts). See also tbl.2. CG1700ORG02 Table Notes_Local Governments by Type and State_2017.

¹⁸ See *id.* at tbl.5. County Governments by Population-Size Group and State: 2017 [CG1700ORG05], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 2,105 county governments with populations less than 50,000. This category does not include subcounty (municipal and township) governments.

¹⁹ See *id.* at tbl.6. Subcounty General-Purpose Governments by Population-Size Group and State: 2017 [CG1700ORG06], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 18,729 municipal and 16,097 town and township governments with populations less than 50,000.

²⁰ See *id.* at tbl.10. Elementary and Secondary School Systems by Enrollment-Size Group and State: 2017 [CG1700ORG10], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 12,040 independent school districts with enrollment populations less than 50,000. See also tbl.4. Special-Purpose Local Governments by State Census Years 1942 to 2017 [CG1700ORG04], CG1700ORG04 Table Notes_Special Purpose Local Governments by State_Census Years 1942 to 2017.

²¹ While the special purpose governments category also includes local special district governments, the 2017 Census of Governments data does not provide data aggregated based on population size for the special purpose governments category. Therefore, only data from independent school districts is included in the special purpose governments category.

²² This total is derived from the sum of the number of general purpose governments (county, municipal and town or township) with populations of less than 50,000 (36,931) and the number of special purpose governments—independent school districts with enrollment populations of less than 50,000 (12,040)—from the 2017 Census of Governments - Organizations tbls. 5, 6 & 10.

²³ See U.S. Census Bureau, 2017 NAICS Definition, “517312 Wireless Telecommunications Carriers (except Satellite),” <https://www.census.gov/naics/?input=517312&year=2017&details=517312>.

wireless video services.²⁴ The SBA size standard for this industry classifies a business as small if it has 1,500 or fewer employees.²⁵ U.S. Census Bureau data for 2017 show that there were 2,893 firms in this industry that operated for the entire year.²⁶ Of that number, 2,837 firms employed fewer than 250 employees.²⁷ Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 594 providers that reported they were engaged in the provision of wireless services.²⁸ Of these providers, the Commission estimates that 511 providers have 1,500 or fewer employees.²⁹ Consequently, using the SBA's small business size standard, most of these providers can be considered small entities.

11. *Fixed Microwave Services.* Fixed microwave services include common carrier,³⁰ private-operational fixed,³¹ and broadcast auxiliary radio services.³² They also include the Upper Microwave Flexible Use Service (UMFUS),³³ Millimeter Wave Service (70/80/90 GHz),³⁴ Local Multipoint Distribution Service (LMDS),³⁵ the Digital Electronic Message Service (DEMS),³⁶ 24 GHz Service,³⁷ Multiple Address Systems (MAS),³⁸ and Multichannel Video Distribution and Data Service (MVDDS),³⁹ where in some bands licensees can choose between common carrier and non-common carrier status.⁴⁰ Wireless Telecommunications Carriers (*except Satellite*)⁴¹ is the closest industry with a SBA small business size standard applicable to these services. The SBA small size standard for this industry

²⁴ *Id.*

²⁵ See 13 CFR § 121.201, NAICS Code 517312 (as of 10/1/22, NAICS Code 517112).

²⁶ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIEM, NAICS Code 517312, <https://data.census.gov/cedsci/table?y=2017&n=517312&tid=ECNSIZE2017.EC1700SIZEEMPFIEM&hidePreview=false>.

²⁷ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

²⁸ Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), <https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf>.

²⁹ *Id.*

³⁰ See 47 CFR Part 101, Subparts C and I.

³¹ See *id.* Subparts C and H.

³² Auxiliary Microwave Service is governed by part 74 of Title 47 of the Commission's Rules. See 47 CFR Part 74. Available to licensees of broadcast stations and to broadcast and cable network entities, broadcast auxiliary microwave stations are used for relaying broadcast television signals from the studio to the transmitter, or between two points such as a main studio and an auxiliary studio. The service also includes mobile TV pickups, which relay signals from a remote location back to the studio.

³³ See 47 CFR Part 30.

³⁴ See 47 CFR Part 101, Subpart Q.

³⁵ See *id.* Subpart L.

³⁶ See *id.* Subpart G.

³⁷ See *id.*

³⁸ See *id.* Subpart O.

³⁹ See *id.* Subpart P.

⁴⁰ See 47 CFR §§ 101.533, 101.1017.

⁴¹ See U.S. Census Bureau, *2017 NAICS Definition*, "517312 Wireless Telecommunications Carriers (*except Satellite*)," <https://www.census.gov/naics/?input=517312&year=2017&details=517312>.

classifies a business as small if it has 1,500 or fewer employees.⁴² U.S. Census Bureau data for 2017 show that there were 2,893 firms that operated in this industry for the entire year.⁴³ Of this number, 2,837 firms employed fewer than 250 employees.⁴⁴ Thus under the SBA size standard, the Commission estimates that a majority of fixed microwave service licensees can be considered small.

12. The Commission's small business size standards with respect to fixed microwave services involve eligibility for bidding credits and installment payments in the auction of licenses for the various frequency bands included in fixed microwave services. When bidding credits are adopted for the auction of licenses in fixed microwave services frequency bands, such credits may be available to several types of small businesses based average gross revenues (small, very small and entrepreneur) pursuant to the competitive bidding rules adopted in conjunction with the requirements for the auction and/or as identified in part 101 of the Commission's rules for the specific fixed microwave services frequency bands.⁴⁵

13. In frequency bands where licenses were subject to auction, the Commission notes that as a general matter, the number of winning bidders that qualify as small businesses at the close of an auction does not necessarily represent the number of small businesses currently in service. Further, the Commission does not generally track subsequent business size unless, in the context of assignments or transfers, unjust enrichment issues are implicated. Additionally, since the Commission does not collect data on the number of employees for licensees providing these services, at this time we are not able to estimate the number of licensees with active licenses that would qualify as small under the SBA's small business size standard.

14. *Satellite Telecommunications.* This industry comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications."⁴⁶ Satellite telecommunications service providers include satellite and earth station operators. The SBA small business size standard for this industry classifies a business with \$38.5 million or less in annual receipts as small.⁴⁷ U.S. Census Bureau data for 2017 show that 275 firms in this industry operated for the entire year.⁴⁸ Of this number, 242 firms had revenue of less than \$25 million.⁴⁹ Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 65 providers that reported they were engaged in the provision of

⁴² See 13 CFR § 121.201, NAICS Code 517312 (as of 10/1/22, NAICS Code 517112).

⁴³ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFI, NAICS Code 517312, <https://data.census.gov/cedsci/table?y=2017&n=517312&tid=ECNSIZE2017.EC1700SIZEEMPFI&hidePreview=false>.

⁴⁴ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

⁴⁵ See 47 CFR §§ 101.538(a)(1)–(3), 101.1112(b)–(d), 101.1319(a)(1)–(2), 101.1429(a)(1)–(3).

⁴⁶ See U.S. Census Bureau, *2017 NAICS Definition, "517410 Satellite Telecommunications,"* <https://www.census.gov/naics/?input=517410&year=2017&details=517410>.

⁴⁷ See 13 CFR § 121.201, NAICS Code 517410.

⁴⁸ See U.S. Census Bureau, *2017 Economic Census of the United States, Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEREVFIRM, NAICS Code 517410, <https://data.census.gov/cedsci/table?y=2017&n=517410&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false>.

⁴⁹ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard. We also note that according to the U.S. Census Bureau glossary, the terms receipts and revenues are used interchangeably. See https://www.census.gov/glossary/#term_ReceiptsRevenueServices.

satellite telecommunications services.⁵⁰ Of these providers, the Commission estimates that approximately 42 providers have 1,500 or fewer employees.⁵¹ Consequently, using the SBA's small business size standard, a little more than half of these providers can be considered small entities.

15. *All Other Telecommunications.* This industry is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.⁵² This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems.⁵³ Providers of Internet services (e.g. dial-up ISPs) or Voice over Internet Protocol (VoIP) services, via client-supplied telecommunications connections are also included in this industry.⁵⁴ The SBA small business size standard for this industry classifies firms with annual receipts of \$35 million or less as small.⁵⁵ U.S. Census Bureau data for 2017 show that there were 1,079 firms in this industry that operated for the entire year.⁵⁶ Of those firms, 1,039 had revenue of less than \$25 million.⁵⁷ Based on this data, the Commission estimates that the majority of "All Other Telecommunications" firms can be considered small.

16. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.⁵⁸ Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.⁵⁹ The SBA small business size standard for this industry classifies businesses having 1,250 employees or less as small.⁶⁰ U.S. Census Bureau data for 2017 show that there were 656 firms in this industry that operated for the entire year.⁶¹ Of this number, 624 firms had fewer than 250

⁵⁰ Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), <https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf>.

⁵¹ *Id.*

⁵² See U.S. Census Bureau, 2017 NAICS Definition, "517919 All Other Telecommunications," <https://www.census.gov/naics/?input=517919&year=2017&details=517919>.

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ See 13 CFR § 121.201, NAICS Code 517919 (as of 10/1/22, NAICS Code 517810).

⁵⁶ See U.S. Census Bureau, 2017 Economic Census of the United States, Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2017, Table ID: EC1700SIZEREVFIRM, NAICS Code 517919, <https://data.census.gov/cedsci/table?y=2017&n=517919&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false>.

⁵⁷ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard. We also note that according to the U.S. Census Bureau glossary, the terms receipts and revenues are used interchangeably. See https://www.census.gov/glossary/#term_ReceiptsRevenueServices.

⁵⁸ See U.S. Census Bureau, 2017 NAICS Definition, "334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing," <https://www.census.gov/naics/?input=334220&year=2017&details=334220>.

⁵⁹ *Id.*

⁶⁰ See 13 CFR § 121.201, NAICS Code 334220.

⁶¹ See U.S. Census Bureau, 2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017, Table ID: EC1700SIZEEMPfirm, NAICS Code 334220, <https://data.census.gov/cedsci/table?y=2017&n=334220&tid=ECNSIZE2017.EC1700SIZEEMPfirm&hidePreview=false>.

employees.⁶² Thus, under the SBA size standard, the majority of firms in this industry can be considered small.

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

17. The rule changes adopted in the *Report and Order* will impose some new and/or additional reporting, recordkeeping, or other compliance requirements on small entities who obtain licenses in the 70/80/90 GHz bands. These requirements are consistent with the requirements the Commission has adopted for other mmW bands; as a result, small entities will potentially have less of a learning curve in their efforts to comply with the adopted rules.

18. In 2003, the Commission established service rules for non-federal use of the 70/80/90 GHz bands through a two-step, non-exclusive licensing regime.⁶³ Small entities and other applicants obtain a nationwide, non-exclusive license for the entire 12.9 gigahertz of the 70/80/90 GHz bands, and then register individual links in a database administered by third-party database managers.⁶⁴ In order for a link to be registered, it must be coordinated successfully with federal operations, typically through the National Telecommunications and Information Administration's (NTIA) online, automated mechanism.⁶⁵ Also, the licensee must provide an analysis to the third-party database manager demonstrating that the proposed link will neither cause harmful interference to, nor receive harmful interference from, any previously registered non-government link.⁶⁶ Licensees are afforded first-in-time priority for successfully registered links relative to links that are successfully registered at a later point in time.⁶⁷ Registered links must be constructed within 12 months of their registration. Under part 101, non-federal licensees may use the 70/80/90 GHz bands for any point-to-point, non-broadcast service.⁶⁸

19. Many of the rule changes adopted in the *Report and Order* are consistent with and mirror existing Commission policies and requirements used in other part 101 spectrum bands, which we expect will help minimize some of the compliance burdens associated with the adopted rules. For example, while we do add a construction certification requirement that licensees certify that each link is constructed and operating within 12 months of successful registration in the link registration system (LRS) administered by third-party database managers, small entities with existing licenses in other bands may already be familiar with similar policies and requirements and have the processes and procedures already

⁶² *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

⁶³ *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Report and Order, 18 FCC Rcd 23318, 23322, para. 5 (2003) (*70/80/90 GHz Report and Order*).

⁶⁴ Since 2004, the Wireless Bureau has designated four entities to be database managers but there are currently two database managers: Comsearch and Micronet Communications, Inc. See, e.g., <https://www.fcc.gov/millimeter-wave-708090-ghz-service>.

⁶⁵ See 47 CFR § 101.1523(b). If a proposed link does not interfere with existing federal operations then it is given a “green light;” if it may interfere with existing federal operations, then it is given a “yellow light,” indicating that the licensee must file a registration application for the link with the FCC for coordination with NTIA. See 47 CFR § 101.1523(b)(3),(c); *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23342–43, para. 54. The “green light” / “yellow light” system protects the sensitive nature of the locations of military installations.

⁶⁶ See 47 CFR § 101.1523(b)(2); *Allocations and Service Rules for 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, WT Docket No. 02-146, Memorandum Opinion and Order, 20 FCC Rcd 4889, 4895–96, paras. 11–14 (2005) (Commission adopted an interference-analysis requirement for registering non-Federal Government licensees).

⁶⁷ See 47 CFR § 101.1523(b)(3); *70/80/90 GHz Report and Order*, 18 FCC Rcd at 23339–40, para. 45. See also *Wireless Telecommunications Bureau Announces Permanent Process for Registering Links in the 71–76 GHz, 81–86 GHz and 92–95 GHz Bands*, Public Notice, 20 FCC Rcd 2261 (WTB 2005).

⁶⁸ 47 CFR § 101.1507.

in place to facilitate compliance, resulting in minimal incremental costs to comply with our requirements for the 70/80/90 GHz bands. We also adopt de minimis modifications to link registrations, which allow licensees to amend their registered links without losing their first-in-time rights for those links. Adopting this rule allows small and other licensees to maintain the existing operation of their links without sacrificing either the accuracy of the database or the licensee's interference-protection rights. Additionally, the Commission believes small entities will continue to benefit from their ability to obtain more information than was previously available to them, such as access to the third-party databases and FCC rulemakings, but with improvements to the data within the database that will result from the construction certification requirement.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

20. The RFA requires an agency to provide “a description of the steps the agency has taken to minimize the significant economic impact on small entities . . . including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.”⁶⁹

21. In the *Report and Order*, the Commission adopts measures to meet the great demand for wireless broadband connectivity in an efficient and effective manner. While doing so, the Commission is mindful that small licensees and service providers will incur some new and/or additional compliance requirements that may also result in increased costs. In adopting the proposed rules, we weighed the impact of these obligations on small entities against the public interest benefits gained from them and have determined that the benefits outweigh the costs. Both the specific steps the Commission has taken to minimize costs and reduce the economic impact for small entities and the alternatives considered are discussed below.

22. For example, through the adopted rules, the Commission took the step of changing our antenna standards to allow licensees, some of which are small entities, to use smaller, lower-cost antennas in the 70 GHz and 80 GHz bands for 5G backhaul. Taking this approach will allow for more intensive use of these bands by small and other entities, thus allowing them to further develop and expand their businesses. Alternatively, we considered not utilizing this approach, due to a concern that reducing antenna size would impact the number of links using the 71–76 and 81–86 GHz bands in metro areas.⁷⁰ However, the benefit of allowing for greater use of the bands outweighed this concern. The Commission also minimized the economic impact on small and other entities through our adoption of the de minimis modification requirement, which ensures that licensees can amend their registrations and not lose their first-in-time status for their registered links, as long as their modifications are consistent with the adopted requirements. The adopted de minimis standard for modifications will be a particular boon to small entities, who may already have limited resources and would likely be disproportionately burdened if their need to repair or replace installed and operating equipment did not change the potential risk of a link causing or receiving interference, yet still caused them to “lose their place in line.” We considered, but declined to adopt, proposals from commenters that we determined were beyond a de minimis modification, such as those that would change the interference landscape.

23. The Commission also considered but rejected arguments requiring construction certifications be filed in the Universal Licensing System (ULS). The Commission instead focused on targeted changes to improve efficiency in high-capacity bands critical to accelerating the deployment of 5G services nationwide. We expect our approach of opting to modify existing rules as minimally as possible instead of creating numerous new and/or additional rules, should minimize the economic impact for small entities and promote greater use of the band among all providers.

⁶⁹ 5 U.S.C. § 604(a)(6).

⁷⁰ Fiberless Networks Corporation Comments at 12.

24. To the extent the cost of complying with these burdens is relatively greater for smaller entities than for large ones, the Commission believes equal application of the rules is necessary to effectuate the purpose of the Communications Act, namely, to further the efficient use of spectrum and to prevent spectrum warehousing. Likewise, equal application of compliance with our technical rules and coordination requirements for all licensees is necessary for the furtherance of the Commission's goals of protecting the public while facilitating the provision of interference-free services by licensees.

G. Report to Congress

25. The Commission will send a copy of the *Report and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.⁷¹ In addition, the Commission will send a copy of the *Report and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Report and Order*, and FRFA (or summaries thereof) will also be published in the *Federal Register*.⁷²

⁷¹ See 5 U.S.C. § 801(a)(1)(A).

⁷² See 5 U.S.C. § 604(b).

APPENDIX C

Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ the Federal Communications Commission (Commission) has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies proposed in the *Further Notice of Proposed Rulemaking (Further Notice)*. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments provided on the first page of the *Further Notice*. The Commission will send a copy of the *Further Notice*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).² In addition, the *Further Notice* and the IRFA (or summaries thereof) will be published in the Federal Register.³

A. Need for, and Objectives of, the Proposed Rules

2. In the *Further Notice*, the Commission considers and seeks comment on whether—and if so, how—it might include Fixed Satellite Service (FSS) earth stations in the third-party database registration regime currently used for operations in the 70 GHz and 80 GHz bands. Included in the Commission’s discussion of potential rule changes and requests for comments in the *Further Notice* are repeated requests from the Space Exploration Technology Corporation (SpaceX), which has advocated for the inclusion of FSS into the existing light-licensing regime for the 70/80/90 GHz bands.⁴ The *Further Notice* seeks comment on issues including whether it would be feasible to include FSS in the database regime process, and whether doing so would have any negative effects on incumbent services. The Commission also solicits comment on what changes to the database system might be needed, whether such changes are feasible, how costs for any changes should be allocated and if those costs would have a significant economic impact on small entities either currently operating, or seeking to operate, in those bands. Lastly, the item also asks commenters to address what protection criteria should be adopted if FSS earth stations are incorporated into the third-party database system, on the appropriate criteria for the protection of FSS from other service, and on any changes that might be necessary to our rules or procedures as a logistical matter. In addition, in the *Further Notice*, the Commission seeks comment on whether to permit ship-to-aerostat transmissions as part of the maritime service otherwise authorized in the *Report and Order*.

B. Legal Basis

3. The proposed action is authorized pursuant to sections 4, 303, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154, 303, and 307.

C. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

4. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.⁵ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small

¹ 5 U.S.C. § 603. The RFA, 5 U.S.C. §§ 601–12, was amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² 5 U.S.C. § 603(a).

³ *Id.*

⁴ See, e.g., Comments of Space Exploration Technologies Corp., WT Docket No. 20-133 et al. (filed Dec. 2, 2021); Reply Comments of Space Exploration Technologies Corp., WT Docket No. 20-133 et al. (filed Jan. 3, 2022); Comments of Space Exploration Technologies Corp., WT Docket No. 20-133 et al. (filed Nov. 8, 2023).

⁵ 5 U.S.C. § 603(b)(3).

organization,” and “small governmental jurisdiction.”⁶ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act (SBA).⁷ A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.⁸

5. *Small Businesses, Small Organizations, Small Governmental Jurisdictions.* Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe, at the outset, three broad groups of small entities that could be directly affected herein.⁹ First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the Small Business Administration’s (SBA) Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.¹⁰ These types of small businesses represent 99.9% of all businesses in the United States, which translates to 33.2 million businesses.¹¹

6. Next, the type of small entity described as a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹² The Internal Revenue Service (IRS) uses a revenue benchmark of \$50,000 or less to delineate its annual electronic filing requirements for small exempt organizations.¹³ Nationwide, for tax year 2020, there were approximately 447,689 small exempt organizations in the U.S. reporting revenues of \$50,000 or less according to the registration and tax data for exempt organizations available from the IRS.¹⁴

7. Finally, the small entity described as a “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special

⁶ 5 U.S.C. § 601(6).

⁷ *Id.* § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

⁸ 15 U.S.C. § 632.

⁹ See 5 U.S.C. § 601(3)–(6).

¹⁰ See SBA, Office of Advocacy, “What’s New With Small Business?,” <https://advocacy.sba.gov/wp-content/uploads/2023/03/Whats-New-Infographic-March-2023-508c.pdf> (Mar. 2023).

¹¹ *Id.*

¹² See 5 U.S.C. § 601(4).

¹³ The IRS benchmark is similar to the population of less than 50,000 benchmark in 5 U.S.C. § 601(5) that is used to define a small governmental jurisdiction. Therefore, the IRS benchmark has been used to estimate the number of small organizations in this small entity description. See Annual Electronic Filing Requirement for Small Exempt Organizations – Form 990-N (e-Postcard), “Who must file,” <https://www.irs.gov/charities-non-profits/annual-electronic-filing-requirement-for-small-exempt-organizations-form-990-n-e-postcard>. We note that the IRS data does not provide information on whether a small exempt organization is independently owned and operated or dominant in its field.

¹⁴ See Exempt Organizations Business Master File Extract (EO BMF), “CSV Files by Region,” <https://www.irs.gov/charities-non-profits/exempt-organizations-business-master-file-extract-eo-bmf>. The IRS Exempt Organization Business Master File (EO BMF) Extract provides information on all registered tax-exempt/non-profit organizations. The data utilized for purposes of this description was extracted from the IRS EO BMF data for businesses for the tax year 2020 with revenue less than or equal to \$50,000 for Region 1-Northeast Area (58,577), Region 2-Mid-Atlantic and Great Lakes Areas (175,272), and Region 3-Gulf Coast and Pacific Coast Areas (213,840) that includes the continental U.S., Alaska, and Hawaii. This data does not include information for Puerto Rico.

districts, with a population of less than fifty thousand.”¹⁵ U.S. Census Bureau data from the 2017 Census of Governments¹⁶ indicate there were 90,075 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.¹⁷ Of this number, there were 36,931 general purpose governments (county,¹⁸ municipal, and town or township¹⁹) with populations of less than 50,000 and 12,040 special purpose governments—independent school districts²⁰ with enrollment populations of less than 50,000.²¹ Accordingly, based on the 2017 U.S. Census of Governments data, we estimate that at least 48,971 entities fall into the category of “small governmental jurisdictions.”²²

8. *Wireless Telecommunications Carriers (except Satellite)*. This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves.²³ Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless Internet access, and wireless video services.²⁴ The SBA size standard for this industry classifies a business as small if it has 1,500 or fewer employees.²⁵ U.S. Census Bureau data for 2017 show that there were 2,893 firms in this

¹⁵ See 5 U.S.C. § 601(5).

¹⁶ See 13 U.S.C. § 161. The Census of Governments survey is conducted every five (5) years compiling data for years ending with “2” and “7”. See also Census of Governments, <https://www.census.gov/programs-surveys/cog/about.html>.

¹⁷ See U.S. Census Bureau, 2017 Census of Governments – Organization Table 2. Local Governments by Type and State: 2017 [CG1700ORG02], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. Local governmental jurisdictions are made up of general purpose governments (county, municipal and town or township) and special purpose governments (special districts and independent school districts). See also tbl.2. CG1700ORG02 Table Notes_Local Governments by Type and State_2017.

¹⁸ See *id.* at tbl.5. County Governments by Population-Size Group and State: 2017 [CG1700ORG05], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 2,105 county governments with populations less than 50,000. This category does not include subcounty (municipal and township) governments.

¹⁹ See *id.* at tbl.6. Subcounty General-Purpose Governments by Population-Size Group and State: 2017 [CG1700ORG06], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 18,729 municipal and 16,097 town and township governments with populations less than 50,000.

²⁰ See *id.* at tbl.10. Elementary and Secondary School Systems by Enrollment-Size Group and State: 2017 [CG1700ORG10], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 12,040 independent school districts with enrollment populations less than 50,000. See also tbl.4. Special-Purpose Local Governments by State Census Years 1942 to 2017 [CG1700ORG04], CG1700ORG04 Table Notes_Special Purpose Local Governments by State_Census Years 1942 to 2017.

²¹ While the special purpose governments category also includes local special district governments, the 2017 Census of Governments data does not provide data aggregated based on population size for the special purpose governments category. Therefore, only data from independent school districts is included in the special purpose governments category.

²² This total is derived from the sum of the number of general purpose governments (county, municipal and town or township) with populations of less than 50,000 (36,931) and the number of special purpose governments—independent school districts with enrollment populations of less than 50,000 (12,040)—from the 2017 Census of Governments - Organizations tbls. 5, 6 & 10.

²³ See U.S. Census Bureau, 2017 NAICS Definition, “517312 Wireless Telecommunications Carriers (except Satellite),” <https://www.census.gov/naics/?input=517312&year=2017&details=517312>.

²⁴ *Id.*

²⁵ See 13 CFR § 121.201, NAICS Code 517312 (as of 10/1/22, NAICS Code 517112).

industry that operated for the entire year.²⁶ Of that number, 2,837 firms employed fewer than 250 employees.²⁷ Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 594 providers that reported they were engaged in the provision of wireless services.²⁸ Of these providers, the Commission estimates that 511 providers have 1,500 or fewer employees.²⁹ Consequently, using the SBA's small business size standard, most of these providers can be considered small entities.

9. *Fixed Microwave Services.* Fixed microwave services include common carrier,³⁰ private-operational fixed,³¹ and broadcast auxiliary radio services.³² They also include the Upper Microwave Flexible Use Service (UMFUS),³³ Millimeter Wave Service (70/80/90 GHz),³⁴ Local Multipoint Distribution Service (LMDS),³⁵ the Digital Electronic Message Service (DEMS),³⁶ 24 GHz Service,³⁷ Multiple Address Systems (MAS),³⁸ and Multichannel Video Distribution and Data Service (MVDDS),³⁹ where in some bands licensees can choose between common carrier and non-common carrier status.⁴⁰ Wireless Telecommunications Carriers (*except Satellite*)⁴¹ is the closest industry with a SBA small business size standard applicable to these services. The SBA small size standard for this industry classifies a business as small if it has 1,500 or fewer employees.⁴² U.S. Census Bureau data for 2017 show that there were 2,893 firms that operated in this industry for the entire year.⁴³ Of this number, 2,837

²⁶ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIEM, NAICS Code 517312, <https://data.census.gov/cedsci/table?y=2017&n=517312&tid=ECNSIZE2017.EC1700SIZEEMPFIEM&hidePreview=false>.

²⁷ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

²⁸ Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), <https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf>.

²⁹ *Id.*

³⁰ See 47 CFR Part 101, Subparts C and I.

³¹ See *id.* Subparts C and H.

³² Auxiliary Microwave Service is governed by part 74 of Title 47 of the Commission's Rules. See 47 CFR Part 74. Available to licensees of broadcast stations and to broadcast and cable network entities, broadcast auxiliary microwave stations are used for relaying broadcast television signals from the studio to the transmitter, or between two points such as a main studio and an auxiliary studio. The service also includes mobile TV pickups, which relay signals from a remote location back to the studio.

³³ See 47 CFR Part 30.

³⁴ See 47 CFR Part 101, Subpart Q.

³⁵ See *id.* Subpart L.

³⁶ See *id.* Subpart G.

³⁷ See *id.*

³⁸ See *id.* Subpart O.

³⁹ See *id.* Subpart P.

⁴⁰ See 47 CFR §§ 101.533, 101.1017.

⁴¹ See U.S. Census Bureau, *2017 NAICS Definition*, "517312 Wireless Telecommunications Carriers (*except Satellite*)," <https://www.census.gov/naics/?input=517312&year=2017&details=517312>.

⁴² See 13 CFR § 121.201, NAICS Code 517312 (as of 10/1/22, NAICS Code 517112).

⁴³ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIEM, NAICS Code 517312,

(continued....)

firms employed fewer than 250 employees.⁴⁴ Thus under the SBA size standard, the Commission estimates that a majority of fixed microwave service licensees can be considered small.

10. The Commission's small business size standards with respect to fixed microwave services involve eligibility for bidding credits and installment payments in the auction of licenses for the various frequency bands included in fixed microwave services. When bidding credits are adopted for the auction of licenses in fixed microwave services frequency bands, such credits may be available to several types of small businesses based average gross revenues (small, very small and entrepreneur) pursuant to the competitive bidding rules adopted in conjunction with the requirements for the auction and/or as identified in part 101 of the Commission's rules for the specific fixed microwave services frequency bands.⁴⁵

11. In frequency bands where licenses were subject to auction, the Commission notes that as a general matter, the number of winning bidders that qualify as small businesses at the close of an auction does not necessarily represent the number of small businesses currently in service. Further, the Commission does not generally track subsequent business size unless, in the context of assignments or transfers, unjust enrichment issues are implicated. Additionally, since the Commission does not collect data on the number of employees for licensees providing these services, at this time we are not able to estimate the number of licensees with active licenses that would qualify as small under the SBA's small business size standard.

12. *Satellite Telecommunications.* This industry comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications."⁴⁶ Satellite telecommunications service providers include satellite and earth station operators. The SBA small business size standard for this industry classifies a business with \$38.5 million or less in annual receipts as small.⁴⁷ U.S. Census Bureau data for 2017 show that 275 firms in this industry operated for the entire year.⁴⁸ Of this number, 242 firms had revenue of less than \$25 million.⁴⁹ Additionally, based on Commission data in the 2022 Universal Service Monitoring Report, as of December 31, 2021, there were 65 providers that reported they were engaged in the provision of satellite telecommunications services.⁵⁰ Of these providers, the Commission estimates that approximately

(Continued from previous page) _____

<https://data.census.gov/cedsci/table?y=2017&n=517312&tid=ECNSIZE2017.EC1700SIZEEMPfirm&hidePreview=false>.

⁴⁴ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

⁴⁵ See 47 CFR §§ 101.538(a)(1)–(3), 101.1112(b)–(d), 101.1319(a)(1)–(2), 101.1429(a)(1)–(3).

⁴⁶ See U.S. Census Bureau, *2017 NAICS Definition, "517410 Satellite Telecommunications,"* <https://www.census.gov/naics/?input=517410&year=2017&details=517410>.

⁴⁷ See 13 CFR § 121.201, NAICS Code 517410.

⁴⁸ See U.S. Census Bureau, *2017 Economic Census of the United States, Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEREVFIRM, NAICS Code 517410, <https://data.census.gov/cedsci/table?y=2017&n=517410&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false>.

⁴⁹ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard. We also note that according to the U.S. Census Bureau glossary, the terms receipts and revenues are used interchangeably. See https://www.census.gov/glossary/#term_ReceiptsRevenueServices.

⁵⁰ Federal-State Joint Board on Universal Service, Universal Service Monitoring Report at 26, Table 1.12 (2022), <https://docs.fcc.gov/public/attachments/DOC-391070A1.pdf>.

42 providers have 1,500 or fewer employees.⁵¹ Consequently, using the SBA's small business size standard, a little more than half of these providers can be considered small entities.

13. *All Other Telecommunications.* This industry is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.⁵² This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems.⁵³ Providers of Internet services (e.g. dial-up ISPs) or Voice over Internet Protocol (VoIP) services, via client-supplied telecommunications connections are also included in this industry.⁵⁴ The SBA small business size standard for this industry classifies firms with annual receipts of \$35 million or less as small.⁵⁵ U.S. Census Bureau data for 2017 show that there were 1,079 firms in this industry that operated for the entire year.⁵⁶ Of those firms, 1,039 had revenue of less than \$25 million.⁵⁷ Based on this data, the Commission estimates that the majority of "All Other Telecommunications" firms can be considered small.

14. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.⁵⁸ Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.⁵⁹ The SBA small business size standard for this industry classifies businesses having 1,250 employees or less as small.⁶⁰ U.S. Census Bureau data for 2017 show that there were 656 firms in this industry that operated for the entire year.⁶¹ Of this number, 624 firms had fewer than 250

⁵¹ *Id.*

⁵² See U.S. Census Bureau, *2017 NAICS Definition*, "517919 All Other Telecommunications," <https://www.census.gov/naics/?input=517919&year=2017&details=517919>.

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ See 13 CFR § 121.201, NAICS Code 517919 (as of 10/1/22, NAICS Code 517810).

⁵⁶ See U.S. Census Bureau, *2017 Economic Census of the United States, Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEREVFIRM, NAICS Code 517919, <https://data.census.gov/cedsci/table?y=2017&n=517919&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false>.

⁵⁷ *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard. We also note that according to the U.S. Census Bureau glossary, the terms receipts and revenues are used interchangeably. See https://www.census.gov/glossary/#term_ReceiptsRevenueServices.

⁵⁸ See U.S. Census Bureau, *2017 NAICS Definition*, "334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing," <https://www.census.gov/naics/?input=334220&year=2017&details=334220>.

⁵⁹ *Id.*

⁶⁰ See 13 CFR § 121.201, NAICS Code 334220.

⁶¹ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFI, NAICS Code 334220, <https://data.census.gov/cedsci/table?y=2017&n=334220&tid=ECNSIZE2017.EC1700SIZEEMPFI&hidePreview=false>.

employees.⁶² Thus, under the SBA size standard, the majority of firms in this industry can be considered small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

15. The proposals contemplated in the *Further Notice* may impose new or additional reporting, recordkeeping, and/or other compliance obligations on small entities, as well as on other licensees and applicants if adopted. In particular, there may be new recordkeeping or compliance obligations created if changes are made to the Commission's part 101 technical and/or operational rules in order to accommodate the potential inclusion of FSS earth stations in the third-party database registration regime in the 70 GHz and 80 GHz bands or in order to permit ship-to-aerostat transmissions as part of the maritime service otherwise authorized in the *Report and Order*.

16. At this time, Commission is not currently in a position to determine whether, if adopted, the proposed rules and associated requirements raised in the *Further Notice* would require small entities to hire attorneys, engineers, consultants, or other professionals and cannot quantify the cost of compliance with the potential rule changes and compliance obligations raised herein. In our discussion of these proposals in the *Further Notice*, we have sought comments from the parties in the proceeding, and requested costs and benefits analyses, which may help the Commission identify and evaluate relevant matters for small entities, including any compliance costs and burdens that may result from any matters discussed in the *Further Notice*, or from any proposed rules in the proceeding, should they be adopted.

E. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

17. The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for such small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.⁶³

18. In the *Further Notice*, the Commission has sought to minimize the economic impact on small entities, as well as considered significant alternatives and weigh their potential impact to those entities. For example, in response to SpaceX's advocacy for including FSS into the existing light-licensing regime for the 70/80/90 GHz bands, we considered whether it was feasible to alter the third-party database registration regime to include FSS earth stations as well as what compliance obligations could be adopted to minimize the economic impact to small entities. In addition, in response to Aeronet's advocacy for permitting ship-to-aerostat transmissions in the maritime service otherwise authorized in the *Report and Order*, we considered whether it was feasible to authorize such links as well as what compliance obligations could be adopted to minimize the economic impact on small entities. In order to provide proper notice for potential commenters and to allow for a technical record that will better assist the Commission in adopting rules that will minimize burdens to small and other entities as much as possible, we seek comment on FSS-specific issues and issues related to ship-to-aerostat links.

19. Additionally, we considered what types of changes to the database system would be needed for FSS registrations and if any changes, if adopted, would cause major modifications to the databases, or alternatively, if entirely new database structures would be required. We seek comment from small entities as to what economic or compliance-related challenges they would encounter as a result of

⁶² *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

⁶³ 5 U.S.C. § 604(a)(6).

adopting such changes. We also considered what protection criteria should be included as part of incorporating FSS earth stations into the third-party database system. For example, the Commission could adopt, as SpaceX prefers, the rules found in part 25 as a framework for appropriate FSS operational restrictions, as opposed to using the limits set forth in the Federal Agencies Letter, which was adopted by the Commission for aeronautical operations in these bands. We seek comment on any other operational limits or restrictions that might be required to meaningfully enable database registration for FSS earth stations without risking harmful interference to incumbent and adjacent services. Lastly, we also considered what types of changes to our rules or procedures intended to accommodate FSS in the third-party database system would be necessary, what licensing requirements for satellite operators would be required and what changes would be needed for federal to non-federal coordination in the FSS context.

20. To assist with the Commission's evaluation of the significant economic impact on small entities, and to better evaluate options and alternatives should the proposals in the *Further Notice* be adopted, the Commission has sought comment from the parties. The proposals in this proceeding to accommodate the potential inclusion of FSS earth stations in the third-party database registration regime in the 70 GHz and 80 GHz bands are predicated on requests from SpaceX for the same. The proposals in this proceeding to include ship-to-aerostat transmissions as part of the maritime service otherwise authorized in the *Report and Order* are predicated on requests from Aeronet for the same. In light of these requests, the *Further Notice* seeks comment on how to weigh the inherent public interest considerations involved. The Commission expects to more fully consider the economic impact and alternatives for small entities following the review of comments and costs and benefits analyses filed in response to the *Further Notice*. The Commission's evaluation of this information will shape the final alternatives it considers, the final conclusions it reaches, and any final actions it ultimately takes in this proceeding to minimize any significant economic impact that may occur on small entities.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rules

21. None.

**STATEMENT OF
CHAIRWOMAN JESSICA ROSENWORCEL**

Re: *Modernizing and Expanding Access to the 70/80/90 GHz Bands*, Report and Order and Further Notice of Proposed Rulemaking, WT Docket No. 20-133 (January 24, 2024)

It doesn't seem that long ago that many of us were in lockdown, passing the time by making plans for post-pandemic life, including the places we would go and the friends and family we would visit. Now people across the country are flying again and in record numbers. In fact, last year, over 858 million passengers passed through our airports. That's an increase of nearly 100 million passengers from the year before.

Even before this surge in passengers, the demand for Wi-Fi in-flight often outstripped what many airlines could provide. The same was true for broadband connections onboard passenger ships like ferries and cruises. Connections while in transit fail consumers when too many passengers compete for the same signal and backhaul capacity struggles to keep up.

The good news is that we are taking steps today to keep us all connected—even at 30,000 feet in the air or miles out in the ocean. We are opening up underutilized spectrum in the 70, 80, and 90 GHz bands to provide more innovative ways to provide and use broadband in aviation and maritime settings. But that's not all. We are maximizing the use of these bands by allowing them to also be used for small, lower-cost antennas that can assist with 5G backhaul. So on top of expanding the opportunities for connection in transit, we are growing the opportunities for the use of these bands in places where other backhaul efforts have proved challenging. This approach is smart—because in our post-pandemic world we expect to be connected everywhere and our approach to airwaves like these must keep up.

**STATEMENT OF
COMMISSIONER GEOFFREY STARKS**

Re: *Modernizing and Expanding Access to the 70/80/90 GHz Bands*, Report and Order and Further Notice of Proposed Rulemaking, WT Docket No. 20-133 (January 24, 2024)

In wireless, much of our recent attention appropriately has focused on mid-band spectrum. But over the long term, I wouldn't be surprised if the very short wavelengths all the way up in the 70/80/90 GHz bands also end up serving as a backbone of U.S. communications networks.

These bands are already being deployed on terra firma for 5G backhaul links that step in where carriers can't deploy fiber—and that perform well enough to ensure fiber backhaul isn't missed. Up in space, satellite operators see real potential for these bands to expand the capacity of our satellite broadband networks. And in the area in between, companies have been eyeing these bands to power faster and cheaper alternatives to satellite on planes, ships, and offshore platforms. All of this could translate into higher speeds, lower prices, and more choice for the everyday consumer, whether they're logging in from a city, suburb, or rural community or connecting to an in-flight Wi-Fi network on the go.

This item modernizes our rules to ensure that these services can develop and expand, and that's why I'm proud to support it. And while several steps remain for us, along with our federal partners, to stand up and fully implement the framework, I know that completing the job will remain a top priority. I'm especially glad that, as I urged, we made the framework more efficient for smaller innovators. There are so many important interests at play in these wireless proceedings, and that can make the regulatory process hard to navigate, especially for small businesses trying out something new. But our hard work can facilitate real progress and open up new possibilities for consumers.

I'd like to thank the Wireless Telecommunications Bureau, Office of Engineering and Technology, and staff elsewhere in the Commission who worked on this complex and cross-cutting item. It has my full support.